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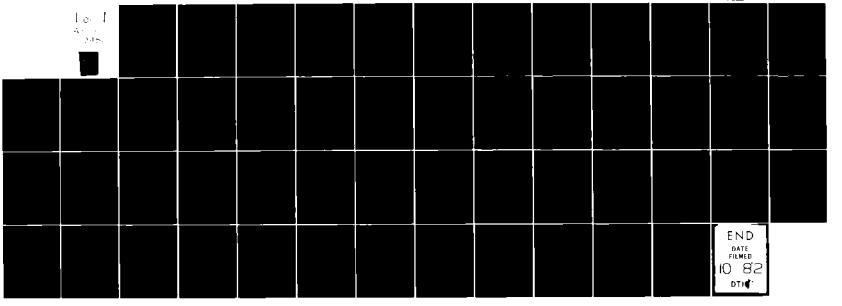

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Beach Profile Analysis System (BPAS)

Volume VI

BPAS User's Guide: Analysis Module VOLCTR

by

Marilyn V. Fleming and Timothy J. Lawler

TECHNICAL REPORT NO. 82-1 (VI)

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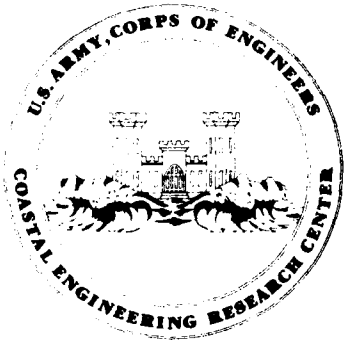

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20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

A package of computer programs for editing, analyzing, and displaying beach profile survey data has been developed. The eight-volume package, named the Beach Profile Analysis System (BPAS), consists of an overview of the BPAS program, two editing programs, five analysis programs, and supporting appendixes.

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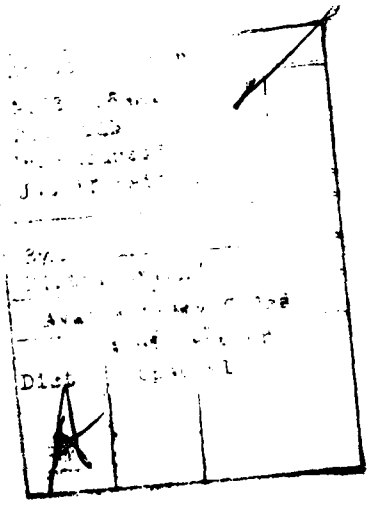
The first editing program checks for missing or unreasonable data, surveying or note-reducing errors, and improper arrangement of data cards. The second editing program assumes that most errors have been corrected and, while it does some minor editing, its major function is to sort, reformat, and store the data on the selected permanent storage media. It is also used to update or extract data from existing files and performs some preliminary data analysis.

The analysis programs compute changes in shoreline position, selected contour positions, sand level, sand volume, and statistical trends and correlations. The results are plotted in a number of ways for display purposes. Output can be specified for English or metric units and can be referenced to any horizontal or vertical datum. Contour positions, including the shoreline position, are interpolated linearly between adjacent surveyed points on the profile. If a survey does not cross the datum elevation, but does reach a specified minimum elevation (e.g., +2 feet MSL), the shoreline position can be extrapolated using the two seawardmost points. Before computing volume changes, common bonds are established relative to the landward and seaward extent of the surveys on each profile line. The computed area under each profile is then expressed in terms of a "unit volume" for a shore-normal slice that is one unit wide. Rates of change in shoreline position and unit volume are computed by linear regression analysis.

The BPAS package has been designed for use primarily on the CDC 6600 computer, although much of the coding was done in standard FORTRAN for use on other systems.



PREFACE

This report is published to provide coastal engineers with the documentation of a package of computer programs for editing, analyzing, and displaying beach profile survey data. This package, named the Beach Profile Analysis System (BPAS), was needed for the analysis of a large data bank of field and laboratory profile surveys. The work was carried out under the U.S. Army Coastal Engineering Research Center's (CERC) Beach Profile Studies work unit, Shore Protection and Restoration Program, Coastal Engineering Area of Civil Works Research and Development.

This report (Vol. VI), the sixth of eight volumes, contains user instructions for the analysis module VOLCTR, which produces tables and plots of change in unit volume between specific contour segments.

The report was prepared by Marilyn V. Fleming and Timothy J. Lawler, Systems Analysts, under the supervision of P. Pierce, Chief, ADP Office, with the assistance of Allan E. DeWall, Geologist, under the supervision of C.J. Galvin, former Chief, Coastal Processes Branch, and Mr. R.P. Savage, Chief, Research Division.

Instrumental insight concerning a previous version of the Beach Profile Analysis System was provided by B. Sims. Programing was accomplished by M. Fleming and T. Lawler with the assistance of D. French, J. Alquist, R. Hylton, and F. Wilson.

The authors acknowledge the helpful discussions and review comments of Drs. C. Everts, C. Galvin, R. Hallermeier, and C. Vincent, and W. Birkemeier, M. Hemsley, A. DeWall, H.C. Miller, B. Sims, and P. Vitale.

Technical Director of CERC was Dr. Robert W. Whalin, P.E., upon publication of this report.

Comments on this publication are invited.

Approved for publication in accordance with Public Law 166, 79th Congress, approved 31 July 1945, as supplemented by Public Law 172, 88th Congress, approved 7 November 1963.

TED E. BISHOP
Colonel, Corps of Engineers
Commander and Director

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FIGURES

CONVERSION FACTORS, U.S. CUSTOMARY TO METRIC (SI) UNITS OF MEASUREMENT

U.S. customary units of measurement used in this report can be converted to metric (SI) units as follows:

Multiply	by	To obtain
inches	25.4	millimeters
	2.54	centimeters
square inches	6.452	square centimeters
cubic inches	16.39	cubic centimeters
feet	30.48	centimeters
	0.3048	meters
square feet	0.0929	square meters
cubic feet	0.0283	cubic meters
yards	0.9144	meters
square yards	0.836	square meters
cubic yards	0.7646	cubic meters
miles	1.6093	kilometers
square miles	259.0	hectares
knots	1.852	kilometers per hour
acres	0.4047	hectares
foot-pounds	1.3558	newton meters
millibars	1.0197×10^{-3}	kilograms per square centimeter
ounces	28.35	grams
pounds	453.6	grams
	0.4536	kilograms
ton, long	1.0160	metric tons
ton, short	0.9072	metric tons
degrees (angle)	0.01745	radians
Fahrenheit degrees	5/9	Celsius degrees or Kelvins[1]

[1]To obtain Celsius (C) temperature readings from Fahrenheit (F) readings, use formula: $C = (5/9)(F - 32)$.

To obtain Kelvin (K) readings, use formula: $K = (5/9)(F - 32) + 273.15$.

BEACH PROFILE ANALYSIS SYSTEM (BPAS)

Volume VI. BPAS User's Guide: Analysis Module VOLCTR

by
Marilyn V. Fleming and Timothy J. Lawler

I. INTRODUCTION

This report, the sixth of eight volumes, provides user instructions for processing analysis module VOLCTR, a part of the Beach Profile Analysis System (BPAS). (Fig. 1). The BPAS is a package of computer programs which edit and analyze beach profile data. The objective of the analysis is to compute and display changes in unit volume, shoreline position, and profile geometry. VOLCTR displays beach profile changes, through time, at a locality by providing plots and tables of unit volume changes between specific contours. Unit volumes within selected contour segments are computed and compared from one survey to the next. Also computed and tabulated are several statistics on unit volume changes between the same surveys at all profile lines.

Volumes I and VIII contain information concerning data collection, formatting and restrictions, and program computations, assumptions, and error messages not repeated in this volume. It is recommended that Volumes I and VIII be used in conjunction with this volume. Volume II, which is a user's guide for processing the editing routines, EDIT1 and EDIT2, contains guidelines for the initial preparation of survey data. These guidelines are not repeated in this volume. Other volumes available in the series are:

(a) Volume III, "BPAS User's Guide: Analysis Module SURVY1," which produces comparative plots of beach profiles.

(b) Volume IV, "BPAS User's Guide: Analysis Module SURVY2," which produces plots and tables of contour positions.

(c) Volume V, "BPAS User's Guide: Analysis Module BEACH," which produces plots and tables of unit volume and shoreline position changes.

(d) Volume VII, "BPAS User's Guide: Analysis Module ELVDIS," which produces tables and plots of change and maximum and minimum elevations at specific distances.

Each of these volumes contains instructions for processing only the module with which it is concerned.

II. PROGRAM DESCRIPTION

The survey input data processed by program VOLCTR (Fig. 2) are assumed to have already been processed through the editing routines, EDIT1 and EDIT2. These edit routines perform a thorough edit and a partial analysis of the data. The result of this preliminary analysis is contained on the first record in the survey data input file, the header record. The information on the header record, along with information specifying desired outputs and optional data specifications, is used to determine whether the data will exceed the program capabilities. If capabilities will be exceeded or the job has been improperly set up, VOLCTR will print an appropriate error message and stop execution after this initial test. Otherwise, the program will continue.

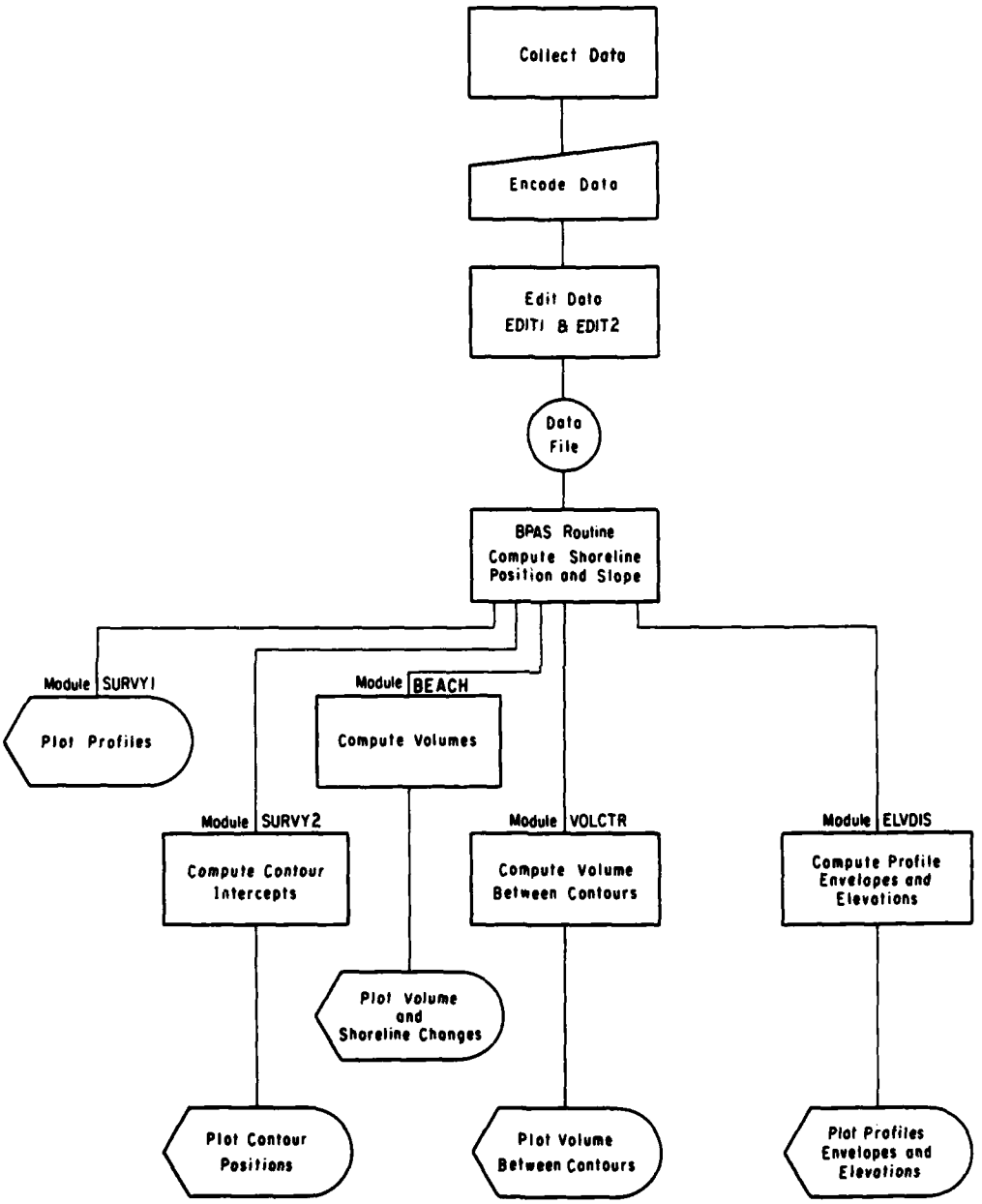


Figure 1. Beach Profile Analysis System.

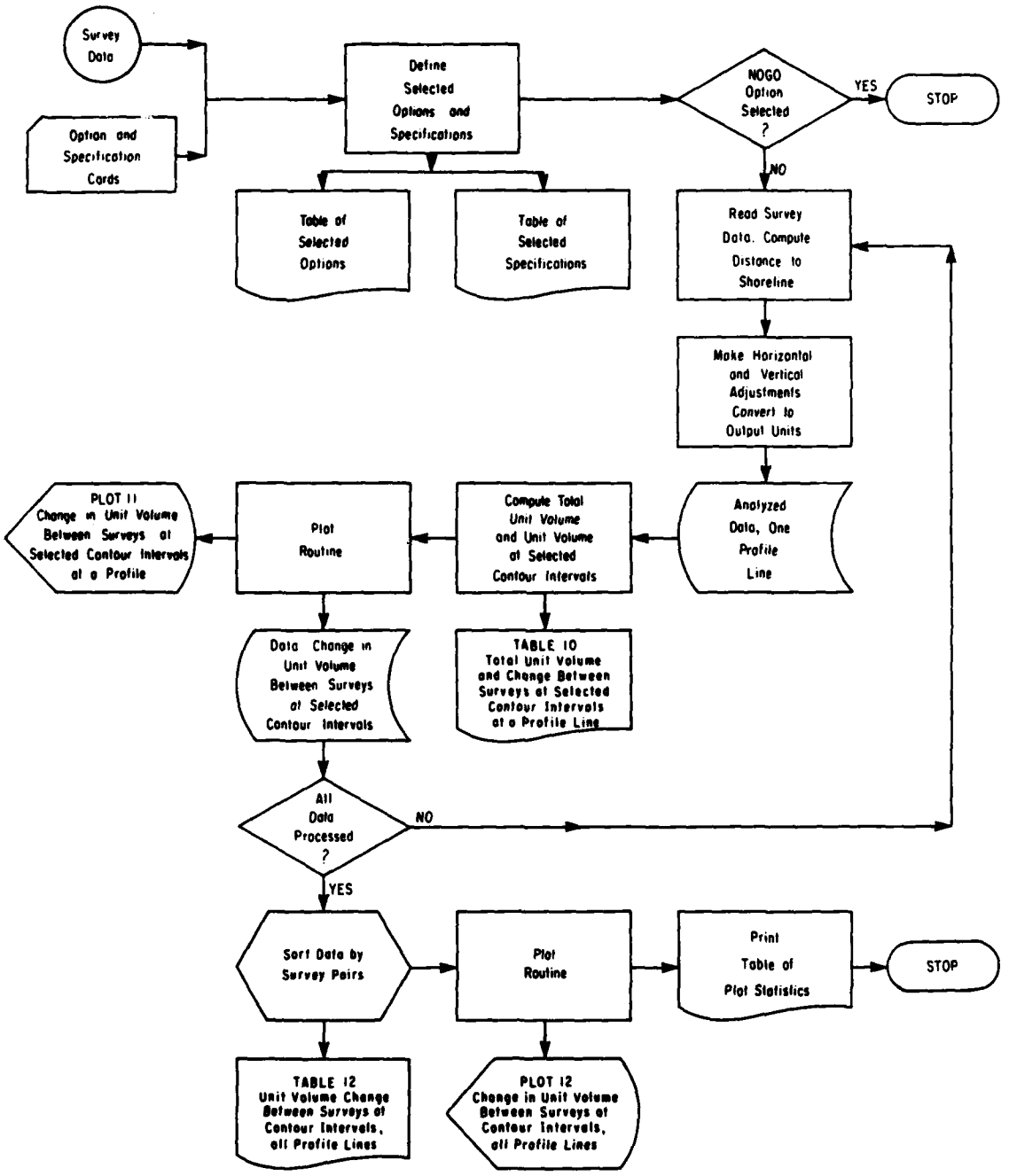


Figure 2. Analysis module VOLCTR.

VOLCTR reads the input data, finds the shoreline position, and produces the requested plots or tables of unit volume changes. Records are read until all data for a single profile line have been processed. As each record is read, the distance to the shoreline, if defined, is computed. If the shoreline position is not a surveyed point, it is interpolated or, optionally, extrapolated and inserted in the record. The appropriate adjustments are made to the data to orient the distances and elevations to the specified output horizontal and vertical datums, and the data are converted to the selected output units of measurement. After all data for a profile line have been processed, common boundaries between consecutive surveys are computed and unit volumes between these and the selected contour segments are computed and compared. The program then reads and processes the data for the next profile line. If the output horizontal datum for any profile line cannot be computed (e.g., no shoreline position is defined on the selected reference survey) there will be no output for that profile line. A message is printed to inform the user.

Output pertaining to all profile lines are produced after all the data have been read. When these outputs have been completed, plot statistics (number of each type of plot produced) are written and execution halts.

III. HARDWARE AND SOFTWARE REQUIREMENTS

VOLCTR is written in extended FORTRAN IV and was designed to take advantage of processing features available on the Control Data Corporation 6600, Cyber 176 or equivalent computer. Such features include the 10-character, 60-bit word size, the FORTRAN-callable sort routine (interfacing with the NOS or NOS/BE operating system SORTMRG utility), and the utility subroutines and functions DATE, TIME, EOF (to check for end of data file), FLOAT, IFIX, ABS, MOD, and the maximum and minimum functions.

General processing requirements include the 500 series CALCOMP plotting instructions, block data subroutines, ENCODE, DECODE, variable dimensions in subroutines, 132-position line printer, a plotter, and 35,000 (decimal) words of core. Also required are the capabilities to process variable length records of up to 635 characters, to perform unformatted reads and writes, to access up to five unique units for input and output, and to use variable formats and variable input and output units in FORTRAN READ and WRITE statements.

A single run producing all available outputs using the input data listed in Appendix G of Volume VIII, 15 surveys of 12 profile lines, required an average of 36,000 words of core and 83 seconds of processing time. There were 430 pages of output and 210 plots. The job created about 17,620 plot cards. The program is dimensioned to process up to 150 surveys of 100 profile lines, each defined with up to 60 coordinate pairs. No more than 100 contour segments may be processed during a single run. Although these dimensions can be modified to process a greater range of data, the procedure for implementing such modifications is beyond the scope of this report.

IV. INPUT DATA

The input data consist of survey records which have been carefully edited and properly formatted by the EDIT1 and EDIT2 programs (see Vol. II). The first record in the survey data file, the header record (Table 1), supplies the range of profile line numbers, survey numbers, and dates. It specifies in

Table 1. Format of the header record.

Position No.	Entry description	FORTRAN format
1-2	00	A2
3-5	Lowest profile line number in data file	I3
6-9	Lowest survey identification number in data file	I4
10-12	Highest profile line number in data file	I3
13-16	Highest survey identification number in data file	I4
17-19	Maximum number coordinate pairs required to define any one survey	I3
20	Number of places to the right of the decimal for distance coordinates	I1
21	Number of places to the right of the decimal for elevation coordinates	I1
22-23	Two-character abbreviation for units of measurement in which data are recorded	A2
24-27	Four-character acronym describing the vertical datum to which data are referenced	A4
28-49	Range of dates, including time, covered by data (yr(I2), mon(I2), d(I2), hr(I3), min(I2))	2(3I2,I3,I2)
50-80	Data description (31 characters)	31A1

what units of measurement the data are recorded, where the decimal should be in the distance and elevation coordinates, and to what vertical datum the data are recorded. This record also contains a 31-character data description. This information is as supplied to or computed by the EDIT2 program. If the information on the header record indicates that the data will exceed any of the program dimensions, an error message is printed and program execution is stopped.

The survey data file, from magnetic media (Table 2) or card images (Table 3), must be sorted by profile line number and then survey number. The module ignores locality codes so all data on a single file should be from the same locality.

V. MODULE OUTPUTS

VOLCTR will produce two tabular and two graphical displays, referred to as TABLE10, TABLE11, PLOT11, and PLOT12. Any or all of these may be produced during a single run. In addition, tables of selected options and specifications are produced by each run of each analysis module. The plot statistics are produced by the analysis modules when plot output has been requested. A footnote or plot legend, "X EXTRAPOLATED DATUM," will appear only if the user has elected to allow extrapolation of the shoreline position.

Table 2. Format of final data file, recorded on magnetic media.

Position No.	Entry description	FORTRAN format
1-2	Locality code	A2
3-5	Profile line number	I3
6-9	Survey identification number	I4
10-15	Date of survey	3I2
16-20	Time of survey	I3,I2
21-23	Number of coordinate pairs in the record	I3
24-28	Minimum elevation on the record	I5
29-35	Blank	7X
36-end	Distance and elevation coordinate pairs, five positions per coordinate, no decimal	I5

Table 3. Format of final data file--card image data.

Position No.	Entry description	FORTRAN format
	First card in each record	
1-2	Locality code	A2
3-5	Profile line number	I3
6-9	Survey identification number	I4
10	Card number (1)	A1
11-16	Date of survey	3I2
17-21	Time of survey	I3,I2
22-24	Number of coordinate pairs in the record	I3
25-29	Minimum elevation this record	I5
30-40	Blank	
41-80	First four distance, elevation coordinate; five columns each coordinate, no decimals[1]	8I5
	Second and following cards in each record	
1-9	Same as for first card	
10	Card number (1-9, then A-Z)	A1
11-80	Seven distance, elevation coordinate pairs, five positions each coordinate	14I5

[1]Position of decimal is defined on the header record (see Table 5).

NOTE.--If there are exactly four coordinate pairs (first card only needed, filled to position 80), the second and the last card in the record must be a blank card.

1. Table of Options Selected (Fig. 3).

This table, produced after all option cards have been read by the program, prints the value assigned to each variable which can be defined on an option card. This table should be examined to ensure that the values assigned to these variables are as anticipated.

```
                    O P T I O N S          MAM RUN  02/03/81  AT  16.46.39.
                    *************

ANALYSIS MODULE SELECTED-- VOLCTR

USER SELECTED RUN ID--    MAM

LOCALITY DESCRIPTOR IS TEST BEACH

EACH SURVEYED LINE WILL BE CALLED A PROFILE

INPUT DISTANCES ARE COMPUTED FROM THE BENCHMARK

INPUT DISTANCES TO FT X 10**0. ELEVATIONS TO FT X 10**0

VERTICAL DATUM IS  MSL
A CORRECTION OF      0.000 FT WILL BE MADE TO EACH VERTICAL CO-ORDINATE.

TIME WILL NOT APPEAR ON OUTPUT.

HORIZONTAL DATUM IS
THE SHORELINE POSITION ON
REFERENCE SURVEY
THERE ARE NO MORE THAN    2 PROFILE LINES.
THE INITIAL SURVEY OF EACH PROFILE LINE WILL BE THE REFERENCE SURVEY.

VOLUME BELOW DATUM WILL NOT BE COMPUTED

A CONVERSION FACTOR OF    1.00000 WILL BE USED TO GO FROM INPUT UNITS (FT) TO
OUTPUT UNITS (FT)

A CONVERSION FACTOR OF     .03704 WILL BE USED TO GO FROM SQUARE FT TO  YDS/FT

EXTRAPOLATION WILL BE DONE TO  MSL IF THE LAST SURVEYED POINT REACHES A MINIMUM
ELEVATION OF      2.000 FT

SURVEY INPUT DATA WILL BE READ FROM UNIT  7 IN THIS FORMAT--
(2X,I3,I4,3I2,I3,I2,I3,F5.0,7X,120F5.0)
```

Figure 3. Sample VOLCTR output--table of options selected.

2. Table of Specifications Selected (Fig. 4).

This table is produced after all special processing and output selection specifications have been read by the program. Anticipated processing specifications and outputs should be compared with those actually selected.

3. TABLE10 (Fig. 5).

This table is produced for each pair of consecutive surveys at each profile line, and it contains the following:

(a) Total unit volume above and below vertical datum for each survey and boundaries for those volumes.

(b) Common boundaries between surveys to be compared.

```
 SPECIFICATIONS SELECTED FOR ANALYSIS MODULE VOLCTR          MAM RUN  02/03/81  AT  10.44.39.

TABLE 10 WILL BE OUTPUT.
TABLE 11 WILL NOT BE OUTPUT.
UPPER LIMIT FOR VOLUME COMPUTATIONS IS PROFILE SURFACE.
LOWER BOUNDARY FOR VOLUME COMPUTATIONS IS     -5.000 FT FROM  MSL
THE CONTOUR SEGMENTS IN WHICH UNIT VOLUME IS COMPUTED WILL BE      1.000 FT WIDE.

                    PLOT 11   PLOT 12

HORIZONTAL AXIS
  MINIMUM            -5.00
  INCREMENT           5.00
  LENGTH              6.00

VERTICAL AXIS
  MINIMUM            -5.00
  INCREMENT           5.00
  LENGTH             12.00

OFFSET               10.00

LINES PER PLOT        5.00

OVERLAP                YES

FACTORING              YES

PLOT COMMANDS WILL BE WRITTEN ON UNIT  3
```

Figure 4. Sample VOLCTR output--table of processing and output specifications selected.

UNIT VOLUME(YD3/FT) CHANGE BY CONTOUR BETWEEN SURVEYS OF PROFILE LINE 1
AT TEST BEACH
HORIZONTAL DATUM IS 6 JAN 75 = 15 DEC 78
THE SHORELINE POSITION ON
6JAN75

TOTAL VOLUME ON 3MAR78 WITH DISTANCE AND ELEVATION
ABOVE MSL BELOW MSL BOUNDARIES OF BOUNDARIES OF
70.798 14.161 =178.886 TO 81.714 =2.000 TO 24.700

CONTOUR (FT ABOVE MSL)	UNIT VOLUME(YD3/FT) BETWEEN CONTOURS ON 3MAR75	ON 28APR75	CHANGE	
(=178.89 TO 4.07)	(=178.89 TO 18.71)		----------	DISTANCE BOUNDS
(0.00 TO 24.70)	(0.00 TO 24.70)		----------	ELEVATION BOUNDS
0.00	6.590	6.946		.355
1.00	6.264	6.682		.418
2.00	5.937	6.395		.458
3.00	5.567	6.107		.540
4.00	5.136	5.815		.679
5.00	4.704	5.519		.815
6.00	4.282	5.203		.921
7.00	4.027	4.770		.743
8.00	3.793	4.003		.210
9.00	3.467	3.290		=.177
10.00	3.130	2.976		=.154
11.00	2.793	2.684		=.109
12.00	2.455	2.432		=.023
13.00	2.170	2.187		.017
14.00	2.003	1.988		=.015
15.00	1.774	1.746		=.028
16.00	1.542	1.498		=.044
17.00	1.311	1.265		=.046
18.00	1.082	1.072		=.011
19.00	.889	.881		=.007
20.00	.716	.705		=.011
21.00	.545	.556		.011
22.00	.375	.411		.036
23.00	.204	.266		.061
24.00	.042	.081		.040
25.00	----------	----------		----------
	70.798	75.476		4.678

Figure 5. Sample VOLCTR output—unit volume changes, by contour, at a profile line, TABLE10.

(c) Unit volume between selected contours during the two surveys.

(d) Change in unit volume at the specified segments from one survey to the next.

(e) Total unit volume within the common boundaries during each survey.

(f) Change in total unit volume within the common boundaries.

There will be at least one page per table. The number of pages per table depends on the number of contour segments the two surveys have in common. Up to 18 contour segments may be written on each page. The last table contains only the total unit volume (item a) during the final survey of the profile line.

4. TABLE11 (Fig. 6).

This table is produced for each set of consecutive surveys and it contains the following data for all profile lines surveyed during both surveys:

(a) Contours bounding the horizontal segments within which the unit volume changes are computed.

(b) Profile line number and unit volume change within the established segments for the profile line.

(c) Total unit volume change at each segment for all the profile lines.

(d) Maximum change, in magnitude, at each segment for all the profile lines considered.

(e) Average change within each segment for all profile lines.

(f) Standard deviation of the change within each segment, all profile lines.

(g) Percentage of profile lines for which there were sufficient data to compute a change for each segment.

(h) Total positive change at each profile line (sum all segments); sum, maximum, average, and standard deviation of the positive changes for all profile lines.

(i) Total negative change at each profile line (sum all segments); sum, maximum, average, and standard deviation of the negative changes for all profile lines.

(j) Total change at each profile line (sum all segments); sum, maximum, average, and standard deviation of the changes for all profile lines.

There is at least one page per table. The total pages depend on the number of contours and the number of profiles to be displayed. Data for 12 contours and 43 profiles may be shown on a single page.

UNIT VOLUME CHANGES (M3/ M) BETWEEN CONTOURS
FROM 2JUL75 TO 9SEP75
AT TEST BEACH

LINE	CONTOUR (M) ABOVE MSL												TOTAL		
	0.00	.75	1.50	2.25	3.00	3.75	4.50	5.25	6.00	6.75	7.50	8.25 9.00	(+)	(-)	SUM
1	1.05	X 2.27	2.67	2.89	1.15	-.46	-.29	-.15	-.21	.08	-.00		10.10	-1.11	9.00
2	-.96	-.85	.80	1.27	-.10	-.39	.21	.26	.01				2.55	-2.29	.26
3	-.66	-.35	1.31	1.57	-2.02	-.33	-.53	-.36					2.88	-4.25	-1.38
4	.91	.94	1.09	1.19	-.07	-.20	-.72	.06	.05	-.10			4.18	-1.09	3.08
5	1.65	2.02	1.79	1.61	-.31	-.68	.32	-1.32	-.57	-.23			7.38	-3.11	4.27
6	-.03	-.92	-1.73	-2.17	-.02	.30	-1.15	-.22					.30	-6.24	-5.94
7	-3.81	-3.47	-.30	1.29	.07	-.27	.09	-.39	-.96	-.01			1.46	-9.21	-7.75
8	.69	2.06	2.97	1.91	.37	.32	.41	.44	.02				9.20	0.00	9.20
9	-1.22	-1.84	-.98	-.89	-.86	-.57	.10	-.25	-.75	-.06			.10	-7.45	-7.35
10	-.01	1.16	1.86	2.46	.08	-.60	-.28	-.08	-.16				5.56	-1.15	4.44
TOTAL	-2.39	1.01	9.49	11.06	-1.70	-2.87	-1.84	-2.02	-2.57	-.33	-.00		43.71	-35.86	7.85
MAX CHG	-3.81	-3.47	2.97	2.89	-2.02	-.68	-1.15	-1.32	-.96	-.23	-.00		10.10	-9.21	9.20
AVERAGE	-.24	.10	.95	1.11	-.17	-.29	-.18	-.20	-.32	-.07	-.00		4.37	-3.59	.78
STD DEV	1.56	1.91	1.54	1.52	.83	.35	.50	.47	.39	.11	0.00		3.58	3.11	6.31
% OCCUR	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	80.00	50.00	10.00				

X EXTRAPOLATED DATUM

Figure 6. Sample VOLCTR output—unit volume changes, by contour, at profile lines, TABLE11.

5. PLOT11 (Fig. 7).

This plot shows the unit volume change between contours for consecutive surveys at each profile line. Data for up to 10 comparative sets of surveys may appear on each plot. If more than one set of surveys is displayed, an offset may be supplied (Fig. 7,a). If there is no offset, each set of surveys will be identified by a unique symbol (Fig. 7,b). When more than one plot is required to represent all surveys at a profile line, subsequent plots may be overlapped so that the last line drawn on one is the first drawn on the next (Fig. 7,a).

6. PLOT12 (Fig. 8).

This plot shows the unit volume change between contours for consecutive surveys. Data for up to 10 profile lines surveyed during the two surveys may be displayed on one plot. If more than one profile line is displayed, an offset may be supplied (Fig. 8,a). If there is no offset (Fig. 8,b), unique symbols will be plotted to differentiate one profile line from the next. If more than one plot is required to represent data for all profile lines, subsequent plots may be overlapped so that the last line drawn on one is the first drawn on the next.

7. PLOT Statistics (Fig. 9).

At the end of each run for which PLOT11 or PLOT12 output was produced, there is a printed table identifying how many sets of axes were drawn for each type of plot. This information may be used to determine how many plots to expect.

VI. JOB STRUCTURE

The job structure for each of the analysis modules is the same (Fig. 10). The only required system separators are those following the system job control cards and signaling the end of the job. The Appendix contains record layouts for each of the option, processing, and output specification cards used by module VOLCTR. If the option and processing specification cards are absent, the module assigns default values. The output specification cards are required only to identify which outputs are desired; there is a default set of specifications for each VOLCTR output. The format and defaults for the option, processing, and output specification cards are described in paragraphs 3, 4, and 5 of this section. Note that the option and specification cards must be followed by a blank card to signal the end of the cards to be read.

The following contains formats for the records needed to run the module. It is recommended that data be right-justified; i.e., the rightmost character or number always occupies the rightmost position in the field. This will ensure that extra zeros are not added to the end of numeric entries when they are read by the module.

1. Program Identification Cards.

The program identification card (Table 4) is mandatory. It allows the user to assign a name to each run, defines which analysis module is to be processed, and provides the option to halt execution after the table of selected options and processing specifications has been printed.

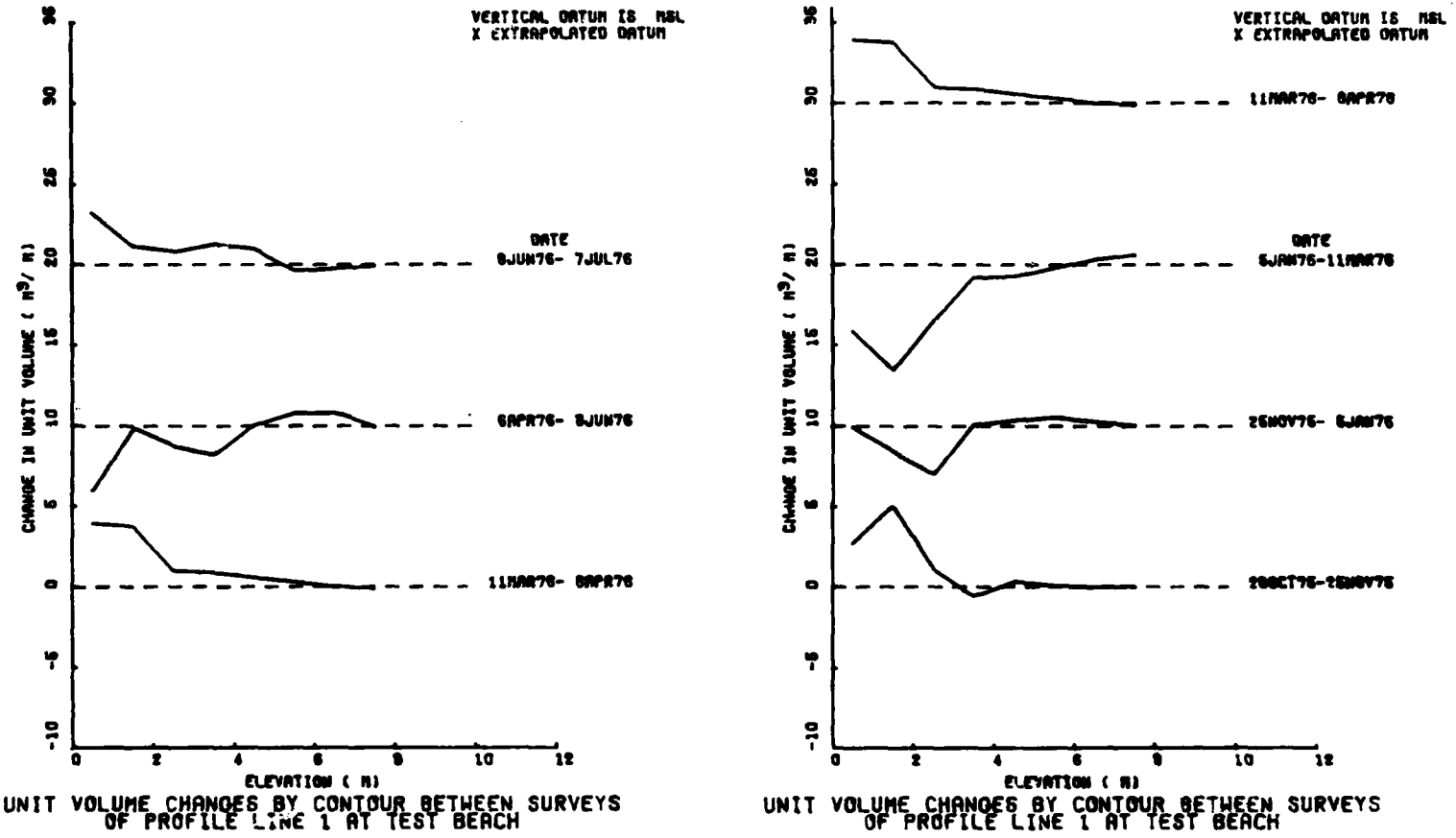


Figure 7a. Sample VOLCTR output—unit volume changes by contour for surveys of a profile line, PLOT11.

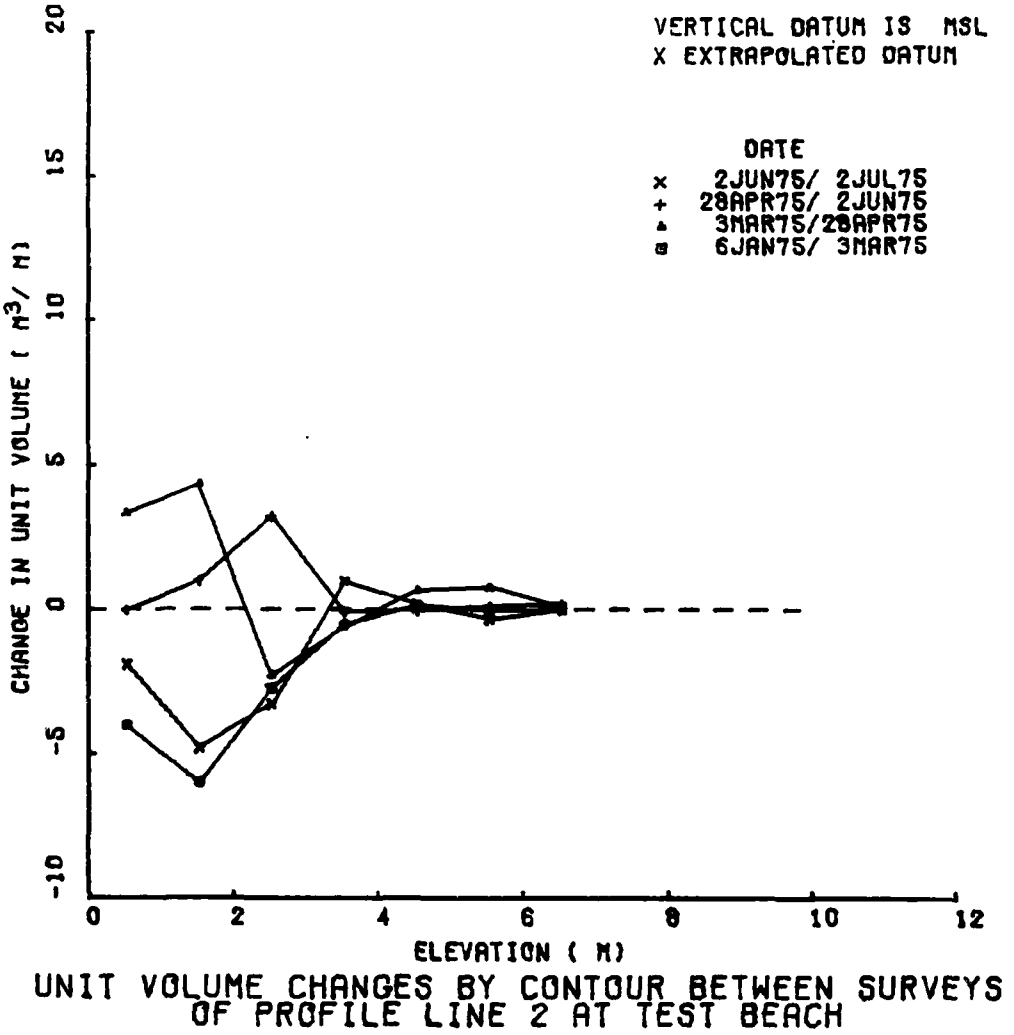
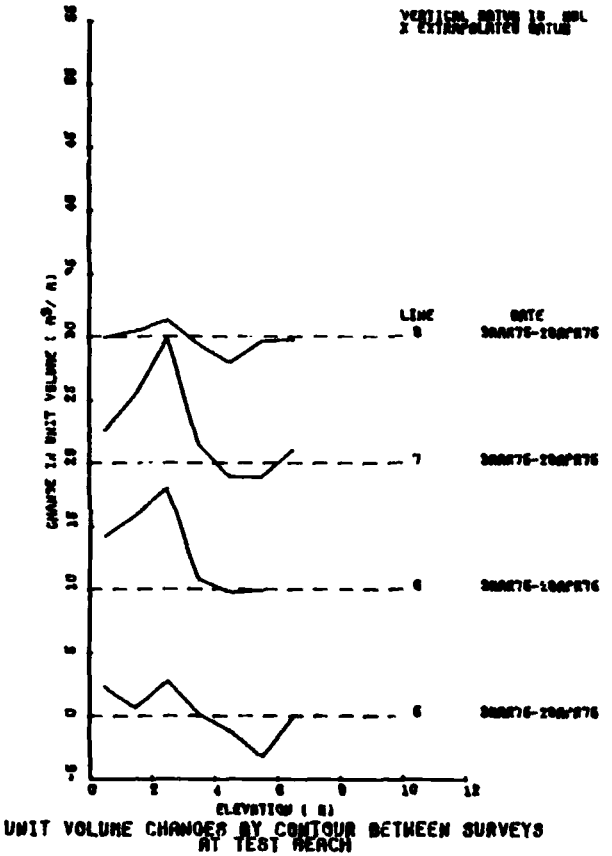


Figure 7b. Sample VOLCTR output—unit volume changes by contour for surveys of a profile line, PLOT11.



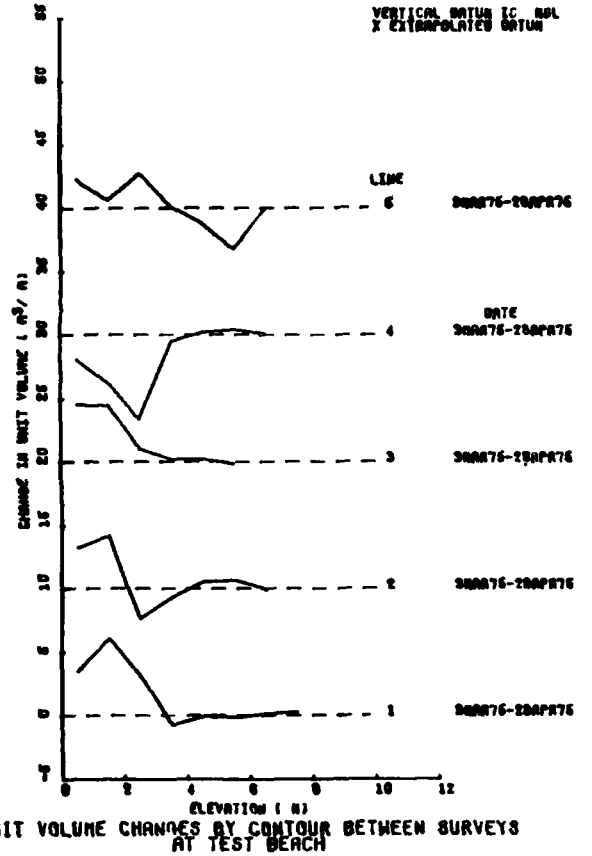


Figure 8a. Sample VOLCTR output—unit volume changes by contour at profile lines, PLOT12.

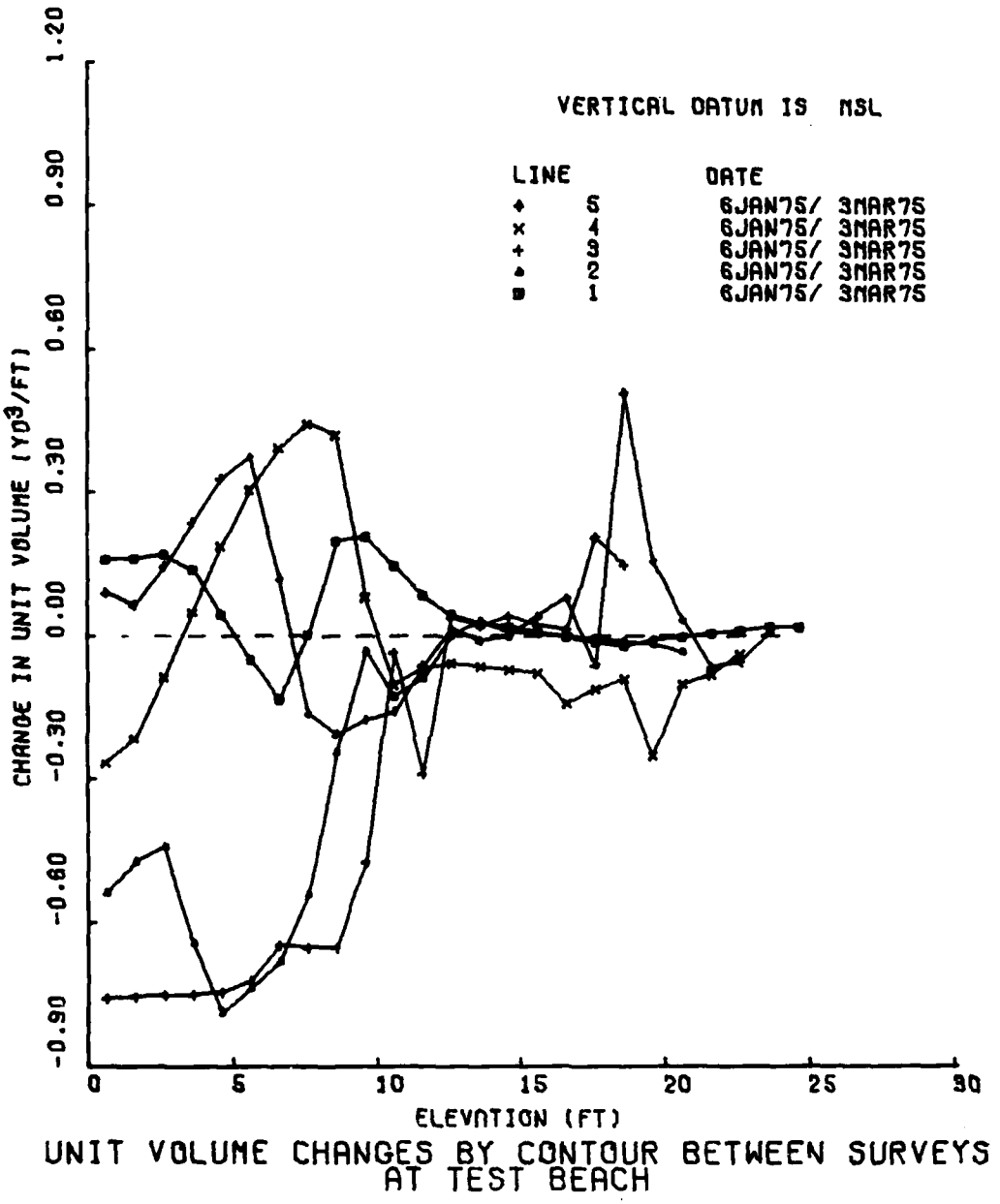
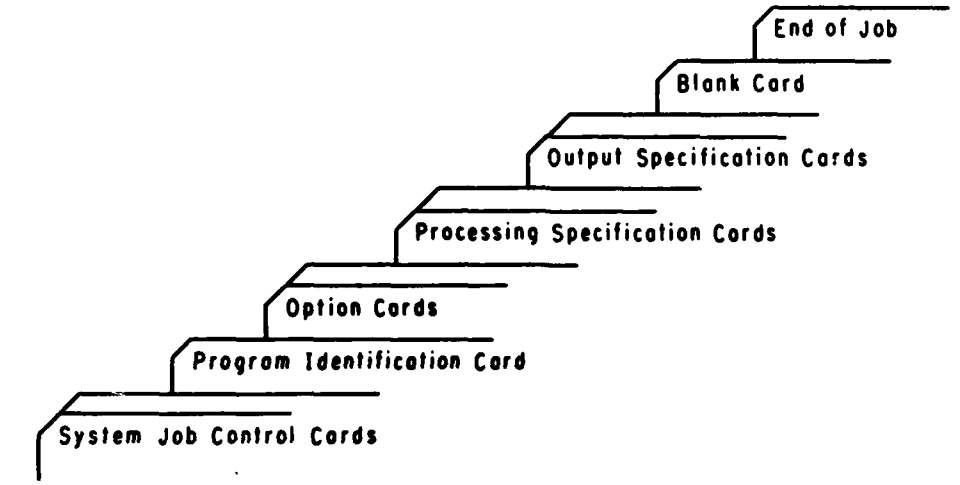


Figure 8b. Sample VOLCTR output—unit volume changes by contour at profile lines, PLOT12.

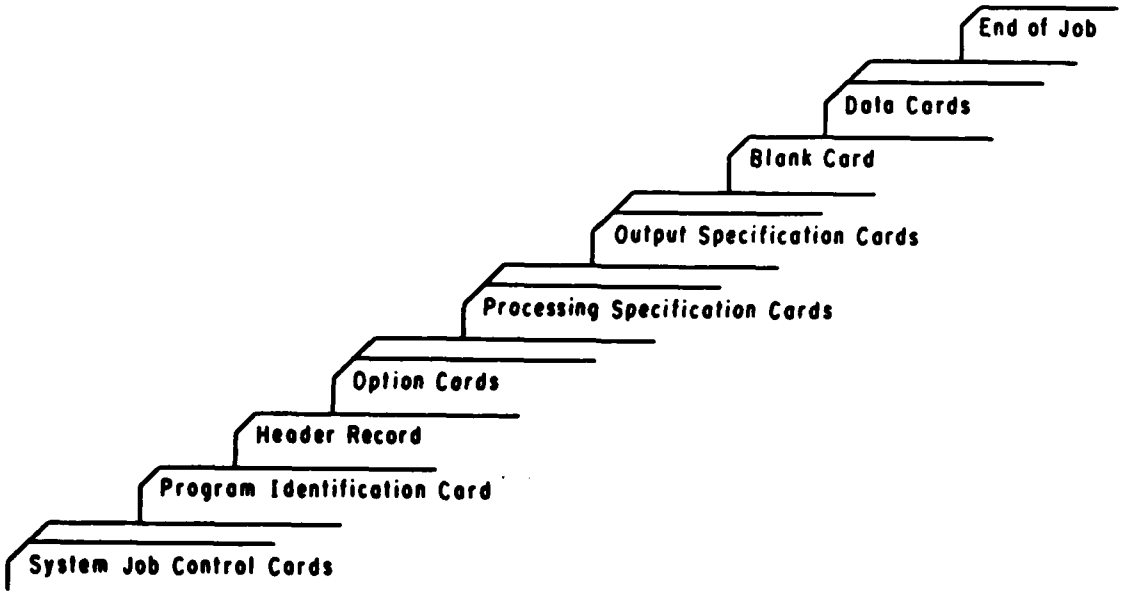
THIS RUN GENERATED THE FOLLOWING GRAPHIC OUTPUT.

PLOT TYPE	NUMBER OF PLOTS
11	6

Figure 9. Sample VOLCTR output--table of plot statistics.



(1) Data on magnetic media. (Survey data file not read from same unit as options and specifications.)



(2) Data on cards or card images. (Survey data file will be read from the same unit as the options and specifications.)

Figure 10. Job structure.

Table 4. Program identification card.

Position No.	Entry description	Default value	FORTRAN format
1-6	Run identification, usually initials of individual submitting job.	None	A6
8-13	Name of analysis module to be processed. This entry is *mandatory*. Enter "VOLCTR."	None	A6
15-16	Unit from which survey data will be read. Enter a "5" in position 16 if data are to be read from cards or card images.	7 (magnetic media)	I2
77-80	Enter "NOGO" to halt execution after printing of options and specifications, otherwise leave blank.	Run will be executed	A4

It is recommended that a printout of selected options and specifications, with further execution suppressed, be the first run for each analysis attempted. To do this, prepare the job and submit it with NOGO in positions 77 to 80 of the program identification card. The printed options (Fig. 3) and specifications (Fig. 4) should be carefully examined to be sure they match those requested. When satisfied that the desired options, specifications, and selected outputs are correct, resubmit the job with positions 77 to 80 blank.

2. The Header Record.

The header record (Table 1) follows the program identification card when data are read from cards or card images. If survey data are read in magnetic media format, the header record is not a part of the deck setup. See Section IV if more information concerning the header record is desired.

3. The Option Cards.

The option cards make it possible for the user to change some of the data characteristics assumed by the programs. None of the option cards are required. Table 5 contains the values assigned when option cards are omitted. If any of the values are to be changed, only the option cards defining the value to be changed need be submitted and only the fields on the card pertaining to that value need be completed. A more detailed description of each option card follows.

a. Option Card 1--Input Horizontal Datum (Table 6). OPT CRD 1 defines the name of the lines surveyed (e.g., profile, range, transect) and the name of the input horizontal datum (e.g., bench mark, base line). If the card is omitted or the pertinent field left blank, the line will be labeled a PROFILE line and the input horizontal datum will be called the BENCH MARK.

b. Option Card 2--Display of Time (Table 7). The date of a survey always appears on outputs, but the time of the survey does not. OPT CRD 2 allows the user to define the type of time, if any, which is to appear on outputs. If the card is omitted or blank, only the date will appear. If the time of day

Table 5. VOLCTR analysis options and their defaults.

Option card	Option	Default value
OPT CRD 1	Name of input horizontal datum	Bench mark
	Name of line surveyed	Profile
OPT CRD 2	Format of time on outputs	No time appears
OPT CRD 3	Abbreviation for new vertical datum and required vertical correction	Abbreviation is as read from header record and no correction is made.
OPT CRD 4	Output horizontal datum	Shoreline position during first survey of each profile line.
OPT CRD 7	Description of the data, for use in titles	As read from the header record
OPT CRD 8	Linear units in which output is to appear	As read from the header record
	Conversion factor to change input linear units to output linear units	1.0
	Cubic units in which output is to appear	If output units are anything but feet, UNIT^3/UNIT; if output units are feet, YD^3/FT.
	Conversion factor to convert squared output units to unit volume	1.0 if output units are not feet; 1/27 if output units are feet.
OPT CRD 9	Whether or not the distance to the shoreline should be extrapolated, and the minimum elevation from which extrapolation is considered valid (>0)	No extrapolation is performed.
OPT CRD 10	Format in which the final data file is to be read.	As necessary to read data as formatted in Table 3 if input is on cards, otherwise as in Table 2.

Table 6. Option card 1--input horizontal datum.

Position No.	Entry description	FORTRAN format
1-3	"OPT"	A3
5-7	"CRD"	A3
9	"1"	I1
11-17	Enter the seven-character name of surveyed line if other than PROFILE.	A7
19-28	Enter the 10-character name of input horizontal datum if other than BENCH MARK.	A10

Table 7. Option card 2--display of time.

Position No.	Entry description	FORTRAN format
1-3	"OPT"	A3
5-7	"CRD"	A3
9	"2"	I1
11	Enter the code for the type of time to be written on printed outputs: 0 - no time is written 1 - 24-hour clock time 2 - decimal time	I1

NOTE.--Date of survey is always displayed on output.

(24-hour clock) or the time, hours and hundredths option is selected, both date and time will be written on outputs. If the latter time option is selected, the minutes will be converted to hundredths of an hour and time displayed as a decimal number.

c. Option Card 3--Output Vertical Datum (Table 8). OPT CRD 3 allows the user to change the vertical datum to which the survey data are referenced. If the card is omitted or left blank, the vertical datum will be as defined on the header record and there will be no change to the vertical coordinates. If a change is desired, enter the four-character abbreviation of the new vertical datum and the amount, in selected *output units*, which must be *added* to each vertical coordinate to make the adjustment.

d. Option Card 4--Output Horizontal Datum (Table 9). OPT CRD 4 allows the user to select the reference horizontal datum to which the output is to be adjusted. If this card is omitted or left blank, the shoreline position during the first survey of each profile line is the output horizontal datum. The distance to the shoreline during the first survey at each profile is computed and this amount is *subtracted* from each distance coordinate. Other choices for the output horizontal datum are: (1) the shoreline position during a survey other than the first, (2) the mean shoreline position, (3) the

Table 8. Option card 3--output vertical datum.

Position No.	Entry description	FORTRAN format
1-3	"OPT"	A3
5-7	"CRD"	A3
9	"3"	I1
11-14	Enter the four-character abbreviation for output vertical datum if other than that on header record.	A4
15-25	Enter the amount, in *output* units, to be *added* to each vertical coordinate.	F10.3

Table 9. Option card 4--output horizontal datum.

Position No.	Entry description	FORTRAN format
1-3	"OPT"	A3
5-7	"CRD"	A3
9	"4"	I1
11-13	Enter the number of profile lines. *Used only when the output horizontal datum is to be user-supplied.* If left blank, the number of profile lines will be as defined on the header record.[1] The program will expect to read an adjustment for the number of lines entered here.	I3
15 (IXDTM)	Enter the type of output horizontal datum selected: 1 or blank - shoreline position during first or defined reference survey of each line 3 - mean shoreline position 4 - no adjustment to distance coordinates 5 - user-supplied. Adjustments entered on SUP 4A cards.	I1
16-19 (IXDTM = 1 only)	Enter the reference survey number. If blank, program uses the first survey of each line which may or may not be the same for all profile lines. All profile lines not surveyed during the selected reference are eliminated from processing.	I4
16-38 (IXDTM = 5 only)	Enter the first line of description of user-supplied horizontal datum.	2A10,A3
39-67 (IXDTM = 5 only)	Enter the second line of description of user-supplied horizontal datum.	2A10,A9

[1]The header record contains the largest and smallest profile line number. If there is not a profile line associated with each number between, this field should not be left blank.

input horizontal datum (e.g., bench mark--in this case the distance coordinates are unaltered), and (4) a user-supplied correction. If the reference is shoreline position during a selected survey, mean shoreline position, or the input horizontal datum, use the OPT CRD 4, format 1, shown in the Appendix; if it is user-supplied, use OPT CRD 4, format 2.

If the correction is supplied, the user must provide SUP 4A (Table 10) cards to define the amount, in output units, which is to be *subtracted* from each distance coordinate at each profile line. The SUP 4A cards must immediately follow OPT CRD 4, be sequentially numbered, and cannot be included if the output horizontal datum adjustment is not user-supplied. While there need not be an entry on the SUP 4A cards for every profile line in the data set, only those represented will be processed by VOLCTR.

Table 10. Supplementary option cards 4A--distance to output horizontal datum, user-supplied.

Position No.	Entry description	FORTRAN format
1-3	"SUP"	A3
5-6	"4A"	A2
7-9	Sequential card number	I3
11-13	Profile line number	I3
14-23	Corresponding adjustment in output units, to be *subtracted* from each distance coordinate.	F10.3
24-26	Profile line number	I3
27-36	Corresponding adjustment	F10.3
37-39	Profile line number	I3
40-49	Corresponding adjustment	F10.3
50-52	Profile line number	I3
53-62	Corresponding adjustment	F10.3
63-65	Profile line number	I3
66-75	Corresponding adjustment	F10.3

The output horizontal datum option has proven to be useful for plotting profiles with horizontal datums well inland of the active beach, or for comparing lines with datums at varying distances from the shoreline. By adjusting the horizontal datum, profiles are effectively "lined up" at the shoreline, dune crest, or other selected reference distance. Care must be taken to ensure that the horizontal datum exists on the reference survey of each profile line. For example, under default conditions, the reference survey is the first survey of each profile line and the horizontal datum is the distance to the zero elevation at the time of that survey. If this position is not defined (i.e., the survey did not extend far enough seaward), the profile line is eliminated from the data set and any output from that particular line is suppressed.

Care must also be taken to ensure that subsequent runs of the data file have the same reference. When data are extracted from larger sets or new data are added to existing sets, it is possible that the first survey of a line will change; it is certain that the mean shoreline position will change. Under these circumstances, the user should record the distance to the horizontal datum for the original data set and supply it on SUP 4A card during subsequent runs.

e. Option Card 7--Data Description (Table 11). The description of the data (e.g., locality or site name) contained on the header record will appear on each output. If the user wishes to change this description, OPT CRD 7 may be used. If the card is omitted or left blank, the data description will be as defined on the header record.

Table 11. Option card 7--data description.

Position No.	Entry description	FORTRAN format
1-3	"OPT"	A3
5-7	"CRD"	A3
9	"7"	I1
11-41	Enter the 31-character data description which supersedes the description on the header record.	3A10,A1

f. Option Card 8--Linear Output Units (Table 12). OPT CRD 8 is used to define the linear and cubic output units. If the card is omitted or left blank, the linear output units will be the same as the input. If output units are to be meters or centimeters and input is in feet, the conversion factor is supplied by the program. Otherwise, the user must supply the required conversion factor. Each distance and elevation read from the input survey file will be multiplied by this factor. Once linear output units are determined, cubic output units will be expressed as: (1) units per cubic unit unless output units are feet; and (2) cubic yards per foot if output units are feet. If this is not acceptable, an appropriate description and factor to convert squared output units to cubic units may be entered on OPT CRD 8.

g. Option Card 9--Extrapolation to Zero Elevation (Table 13). Since the shoreline position is of major interest in the analysis of beach profile data, there may be cases when the user decides that extrapolating the distance to the zero elevation is valid. In this case, OPT CRD 9 can be used to specify the elevation, in output units relative to the output vertical datum, that the last surveyed point must reach before the shoreline position can be extrapolated. If the card is omitted or left blank, no extrapolation occurs. When any computation is performed using data for which the shoreline position was extrapolated, output of the results of that computation is flagged. No extrapolation will be performed for profiles where the last line segment is not sloping seaward.

h. Option Card 10--Format of Input Data (Table 14). If the format specified for card image data (Table 3) or magnetic media data (Table 2) does

Table 12. Option card 8--linear and cubic output units.

Position No.	Entry description	FORTRAN format
1-3	"OPT"	A3
5-9	"CRD"	A3
9	"8"	I1
11-12	Enter the abbreviation for linear output units of measurement. If blank, these will be as defined on the header record.	A2
13-22	Enter the conversion factor. Input units are multiplied by this number to convert to output units. This field may be blank if (a) Input and output units are the same (factor set to 1). (b) Input units are FT; output units are M (factor set to 0.3048). (c) Input units are FT; output units are CM (factor set to 30.48).	F10.3
24-25	Enter the abbreviation for cubic part[1] of unit volume. If blank and (a) Linear output units are FT, this will be YD. (b) Linear output units are not feet, this will be the same as linear output units.	A2
27-28	Enter the abbreviation for linear part[1] of unit volume. If blank, this will be the same as linear output units.	A2
30-39	Enter the factor to convert squared output units to cubic output units. If blank and (a) Linear output units are feet, this will be 1/27. (b) Linear output units are not feet, this will be 1.0.	F10.3

[1]In the expression YD^3/FT, YD is the cubic part, FT is the linear part.

Table 13. Option card 9--extrapolation to zero elevation.

Position No.	Entry description	FORTRAN format
1-3	"OPT"	A3
5-7	"CRD"	A3
9	"9"	I1
11-20	Enter the maximum elevation above the output vertical datum, in output units, which the last surveyed point must reach in order that the shoreline position (datum intercept) be extrapolated. If this is blank or zero, the shoreline position will not be extrapolated.	F10.3

Table 14. Option card 10--format of input data.

Position No.	Entry description	FORTRAN format
1-3	"OPT"	A3
5-7	"CRD"	A3
8-9	"10"	I2
11-80	Enter the survey data format. If this card is blank or omitted, data will read as follows: (a) Input unit is 5 (2X,I3,I4,1X,3I2, I3,I2,F5.0,11X,8F5.0/(10X,13F5.0)). (b) Input unit is 7 (2X,I3,I4,3I2,I3, I2,I3,F5.0,7X,12OF5.0).	7A10

not fit the format of the user's input data, an alternate format may be specified using OPT CRD 10. Knowledge of FORTRAN format specifications is required to use this option effectively. All the data elements but the locality code are used in the analysis computations. Thus, while this card can be used to change the field length, order or format in which data elements are read, all elements must be present. The expected order of the variables is shown in Tables 2 and 3; the order in which the variables are read may be changed by using the FORTRAN tab or T format specification. The T format specification is described in most FORTRAN texts and reference manuals, e.g., Stuart (1970)[1].

4. Processing Specification Cards.

Although the inclusion of processing specification cards prepared for other modules will not affect processing, the only processing specification used by VOLCTR is the VOLUME specification (Table 15). On this card, the user can specify the upper and lower (≥ 0) elevation boundaries, output units

[1]Stuart, F., *FORTRAN Programming*, John Wiley & Sons, Inc., 1970.

Table 15. Format of VOLUME specification card.

Position No.	Entry description	FORTRAN format	Default value
1-6	"VOLUME"	A6	None
11-20	Lower boundary, in output units relative to output vertical datum. Must be $\geq$0.	F10.3	0.0
21-30	Upper boundary, in output units relative to output vertical datum. Must be more than lower boundary.	F10.3	Profile surface
31-40	Width of segments for unit volume by contour computations (output units).	F10.3	1 unit

relative to output vertical datum, and the segment width (output units) for the volume by contour computations. If there are data of interest below the zero contour, use OPT CRD 3 (paragraph 3,c of this section) to change the vertical datum so that these data will be at or above the new zero elevation.

5. Output Specification Cards.

VOLCTR will produce two tabular and two graphical displays: TABLE10, TABLE11, PLOT11, and PLOT12. These outputs are described in detail in Section V. Any or all of the outputs may be produced during a single run. An output and any required specifications for the output are selected by entering an output specification card. One, and only one, card must be entered for each output selected.

a. Table Output. Table 16 describes the format of the output specification card for TABLE10 (Fig. 5) and TABLE11 (Fig. 6). There are no optional specifications for these tables.

Table 16. Format of TABLE10 and TABLE11 output specification card.

Position No.	Entry description	FORTRAN format	Default value
1-5	"TABLE"	A5	None
8-9	Table number, enter "10" or "11."	I2	None

b. Plot Output. Table 17 describes the format for the output specification cards for plot output (Figs. 7 and 8) and defines the defaults which will be assigned if the cards are not completed. A separate card must be prepared for each type of plot to be output. Generally, it is not necessary that

Table 17. Plot specifications for VOLCTR plot output.

Position No.	Entry description	FORTRAN format	Default value PLOT11	Default value PLOT12
1-4	"PLOT"	A4	None	None
8-9	Plot number (11 or 12)	I2	None	None
11	Output unit for plot commands: "3" - cards "8" - magnetic tape	I1	3	3
12	Default specifications: "0" - yes (use only if output units are feet) "1" - no, remainder of card will be read	I1	Yes	Yes
	Horizontal axis (elevation):			
13-20	origin	F8.2	0.0	0.0
21-27	increment (units per inch on plot)	F7.2	5.0	5.0
28-31	length in inches	F4.1	6.0	6.0
	Vertical axis (change in unit volume):			
33-40	origin	F8.2	-3.0	-3.0
41-47	increment (units per inch on plot)	F7.2	1.0	3.0
48-51	length in inches	F4.1	5.0	5.0
53-54	Lines per plot (maximum 10)	I2	1	5
55-60	Offset	F6.2	5.0	2.0
62-67	Overlap: "OVRLAP" - plots overlapped blank - no overlap	A6	No overlap	No overlap
69	Factoring: "0" - size of plot not altered "1" - size of plot altered	I1	No factoring	No factoring

each type of plot have the same specifications when more than one type is output during a single run; format specifications for each type of plot are read and processed separately. However, the output unit for plot command must agree. If not, the specification read from the last card encountered will be used for both plots.

(1) Output Unit for Plot Commands. The plot commands may be written either to unit 3 (normally signaling card output) or 8 (normally signaling output to magnetic tape). The user must ensure that data written to these units are handled properly in the job control stream.

(2) Default Plot Specification. If the defaults for values supplied in positions 13 to 80 are acceptable and the selected output units of measurement are feet, positions 13 to 80 need not be completed. However, if any plot specifications are to be supplied or output units are not feet, all fields must be completed. (The unit onto which plot commands are to be written may be changed without affecting other default specifications.)

(3) Lines Per Plot. Data for up to 10 survey pairs or profile lines may be drawn on a single plot.

(4) Offset. When changes at more than one survey pair or profile line are drawn on a single plot, the second and subsequent lines may be offset. The offset will be added to vertical coordinates before additional lines are plotted. The offset supplied may be positive, negative, or zero. For PLOT11, the earliest survey pair is plotted first and the remainder offset. For PLOT12, data for the profile line with the largest line number are plotted first.

(5) Overlap. For plot type 11, a new axis is automatically drawn when all data collected at a single profile line have been processed. For plot type 12, a new axis is drawn when all data collected during each survey pair have been processed. When the number of survey pairs or profile lines represented on a single plot is greater than 1, the user may specify that plots be overlapped. The last line depicted on each plot will be the first drawn on the next until there is a change in the profile line number or survey pair. The overlapped profile counts toward the number of lines per plot.

(6) Factoring. The factoring option is used to specify whether or not the final plot size is to be altered before being output. The user has no control over the factor used; this is determined by the length of the longer axis. When plots are factored, the x-axis will be no longer than 5 inches and the y-axis no longer than 6 inches. Plot size will be increased if both axes are shorter and decreased if either is longer.

(7) Defining Axis Length, Increment, and Origin. The outputs from TABLE10 and TABLE11 can be used to define optimal axis length, origin, and increment. Allow an extra inch on both the horizontal and vertical axes so that the plot legend will not interfere with the plotted data. When a large number of plots are to be produced, some test plots should be run and examined before the final production run is submitted.

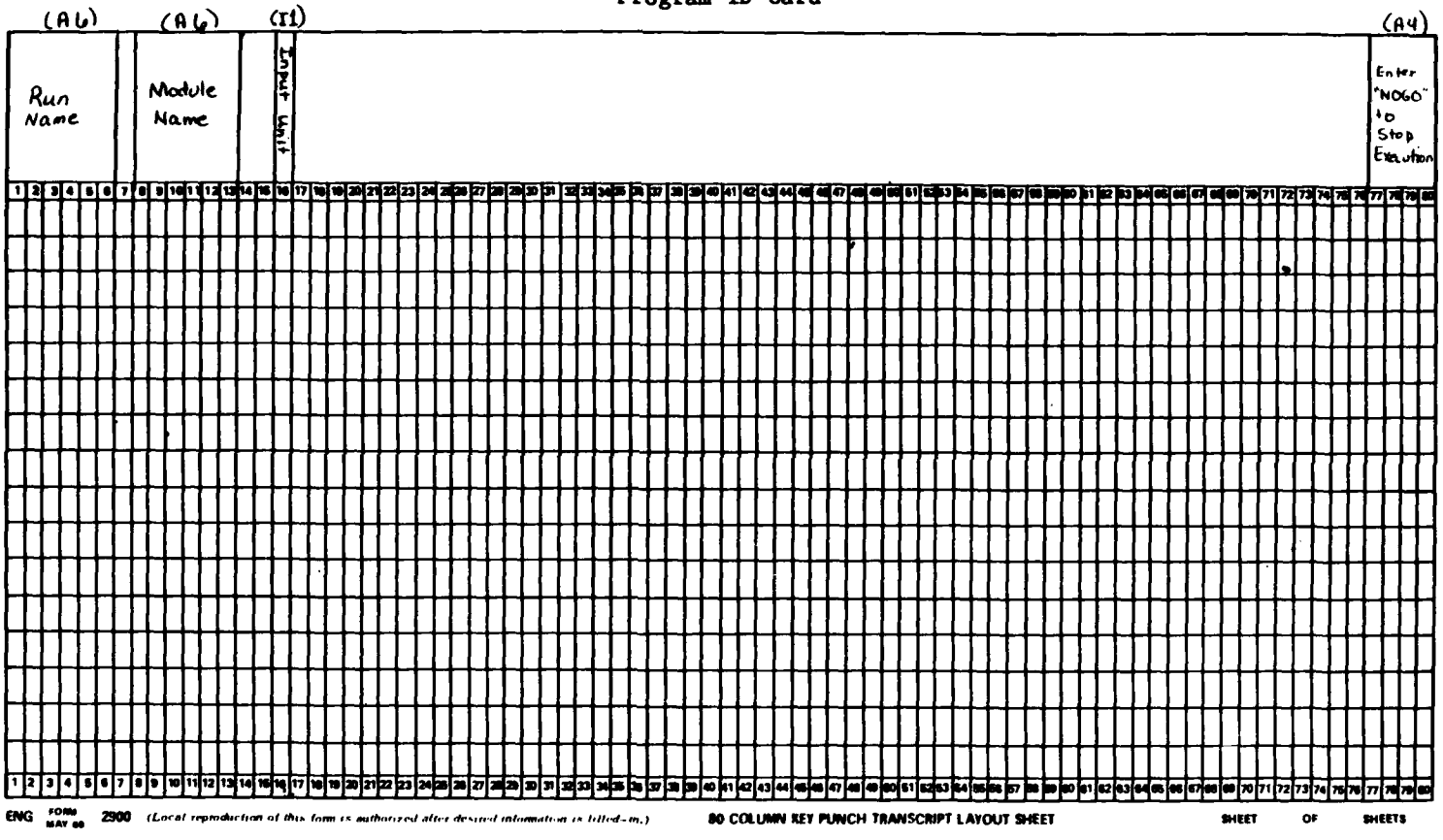
VII. SUMMARY

VOLCTR produces two tabular and two graphical displays. The major function of the module is to display changes at specific contour intervals between surveys. The outputs have been designed so that they can be used in reports without being redrafted.

APPENDIX

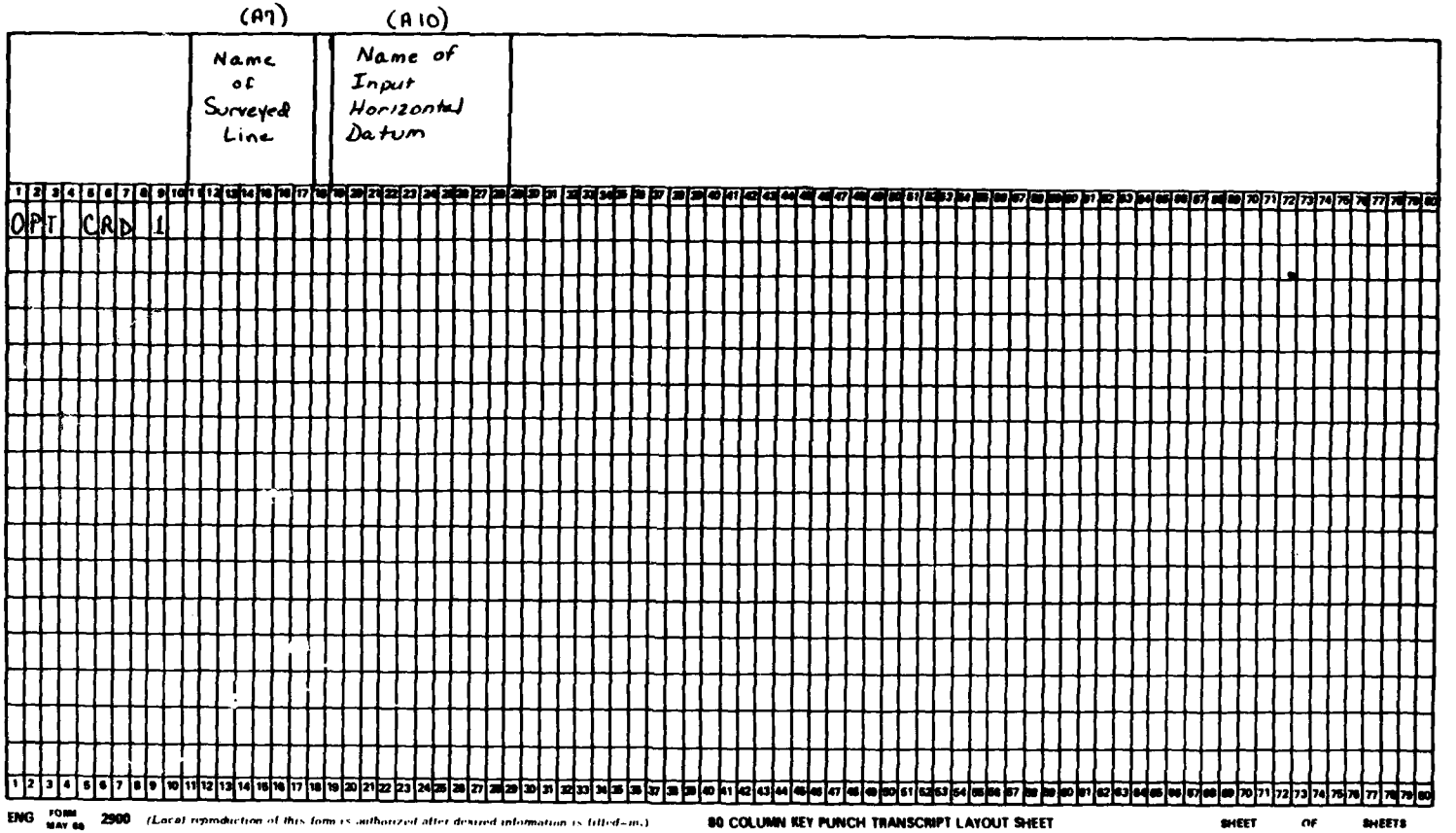
VOLCTR RECORD LAYOUTS FOR OPTION AND OUTPUT SPECIFICATION CARDS

Program ID Card



ENG FORM MAY 68 2900 *(Local reproduction of this form is authorized after desired information is filled-in.)* 80 COLUMN KEY PUNCH TRANSCRIPT LAYOUT SHEET SHEET OF SHEETS

Option Card 1



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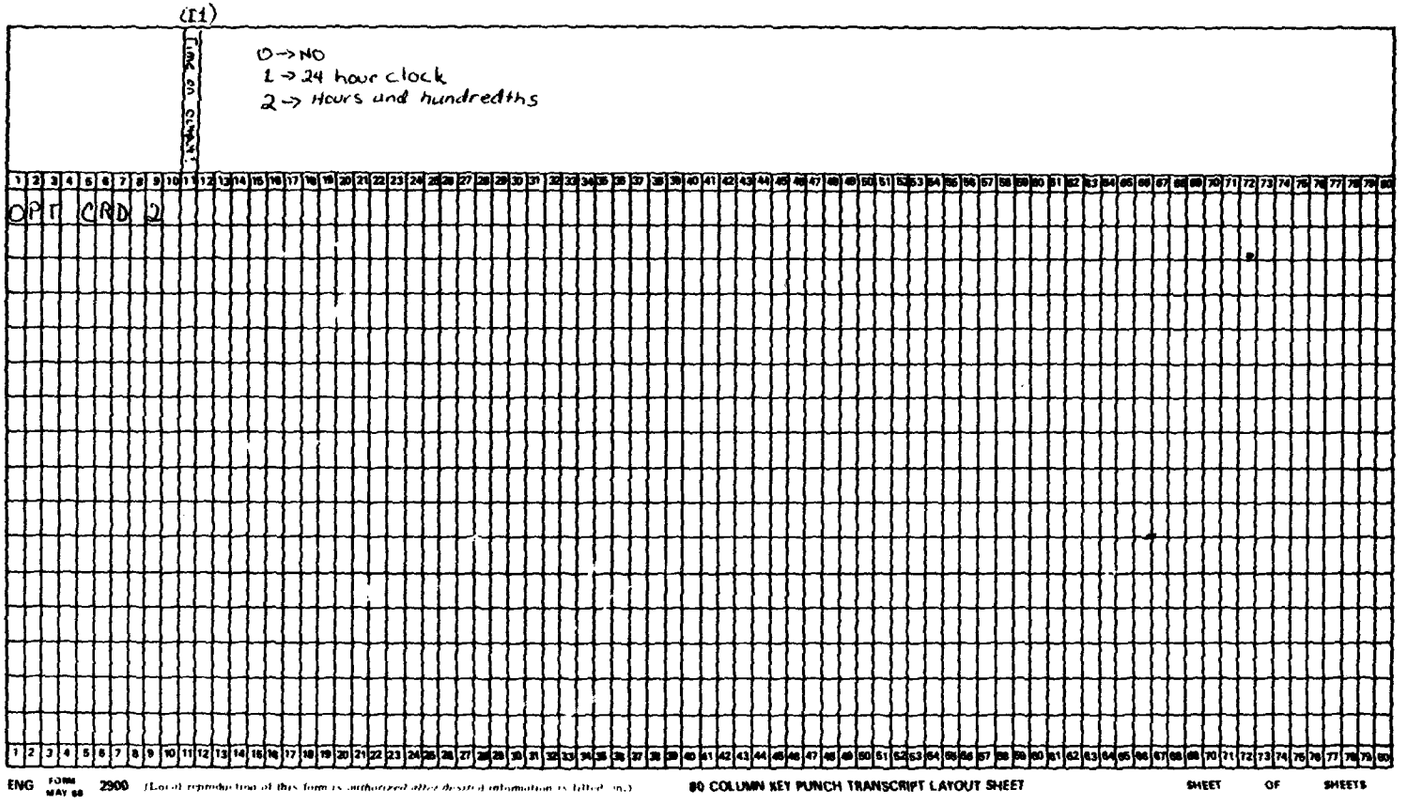
Option Card 2



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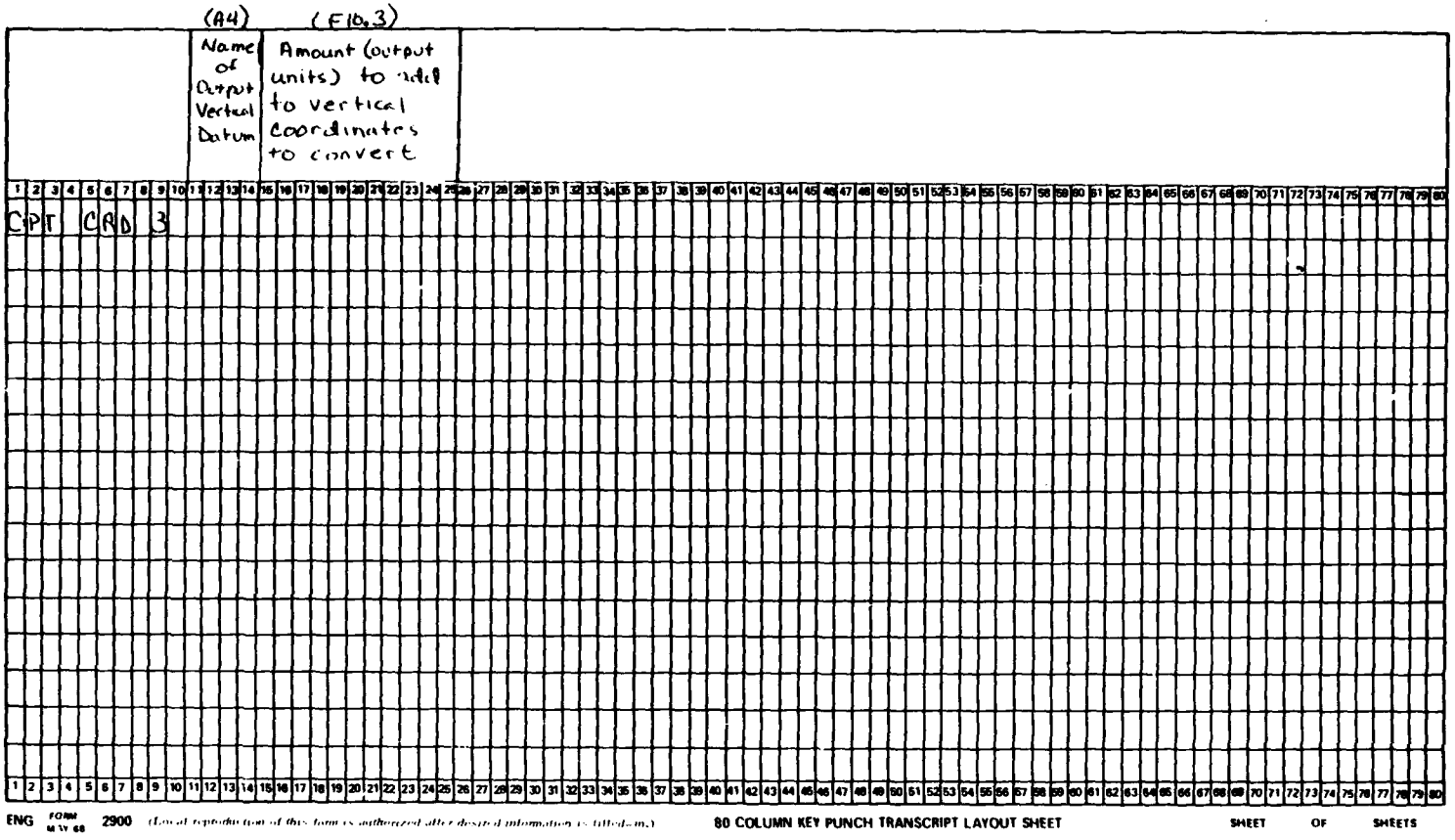
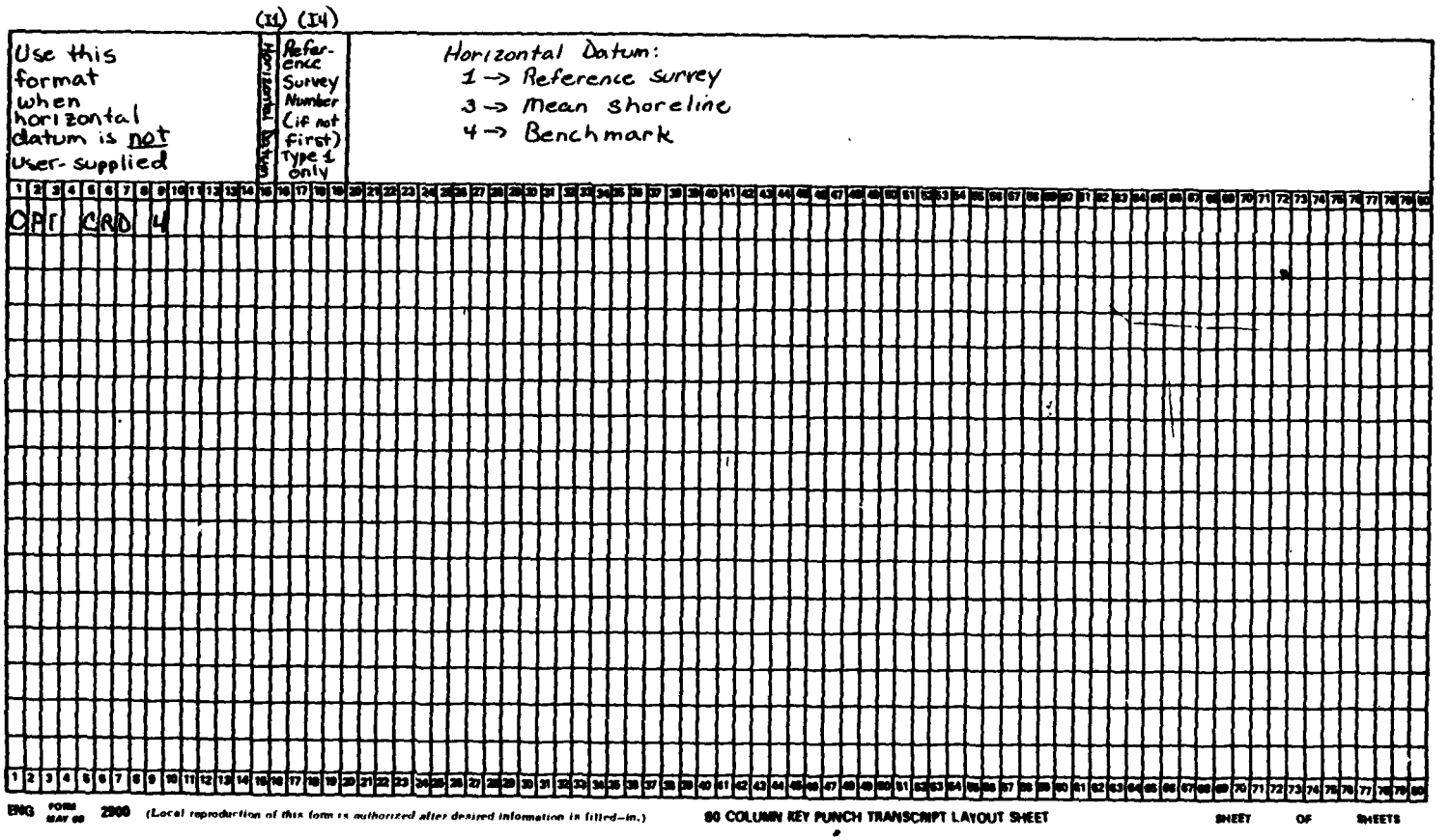
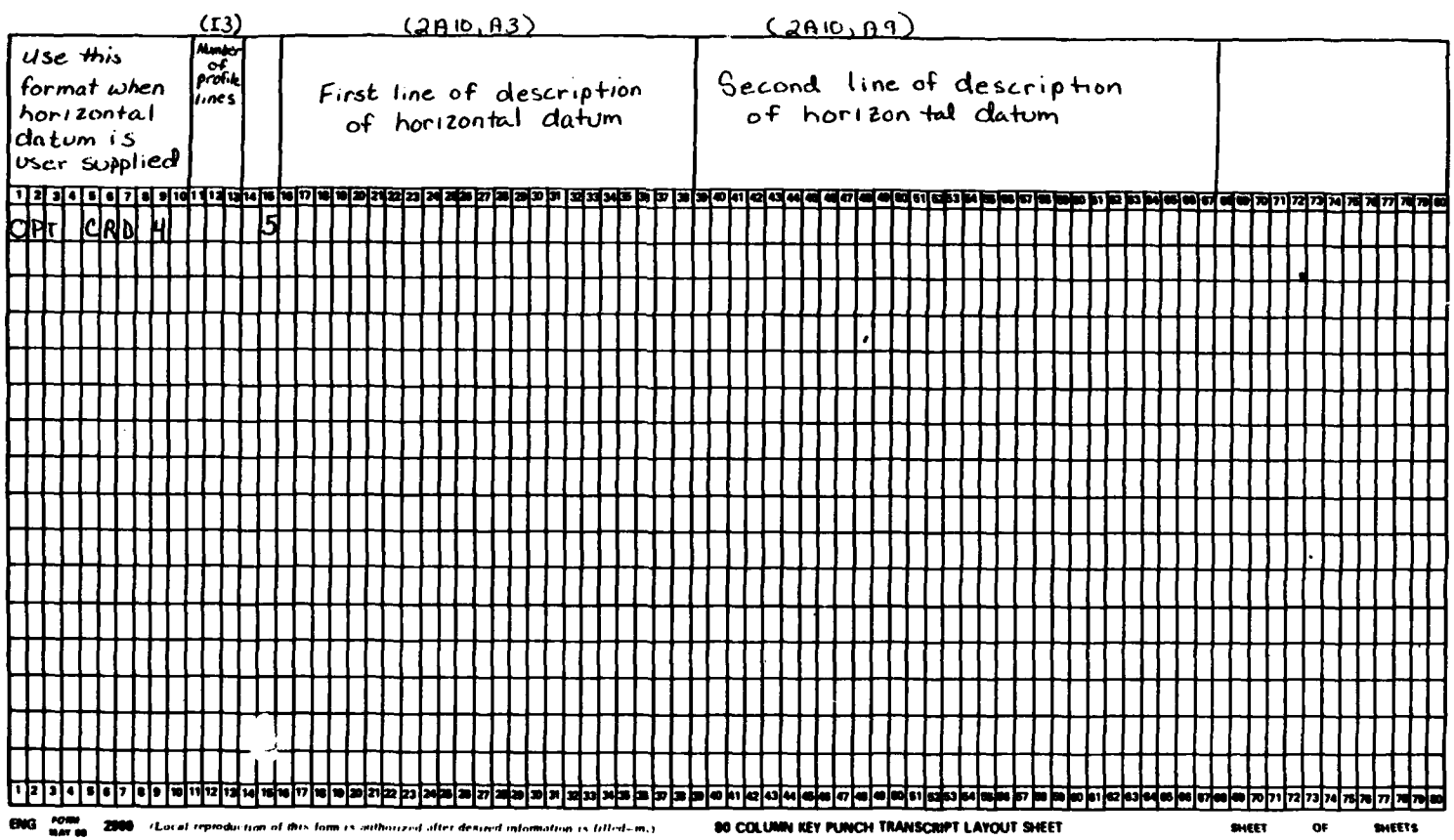
Option Card 3



Option Card 4, Format 1
(may not be followed by SUP 4A cards)



Option Card 4, Format 2
(must be followed by SUP 4A cards)



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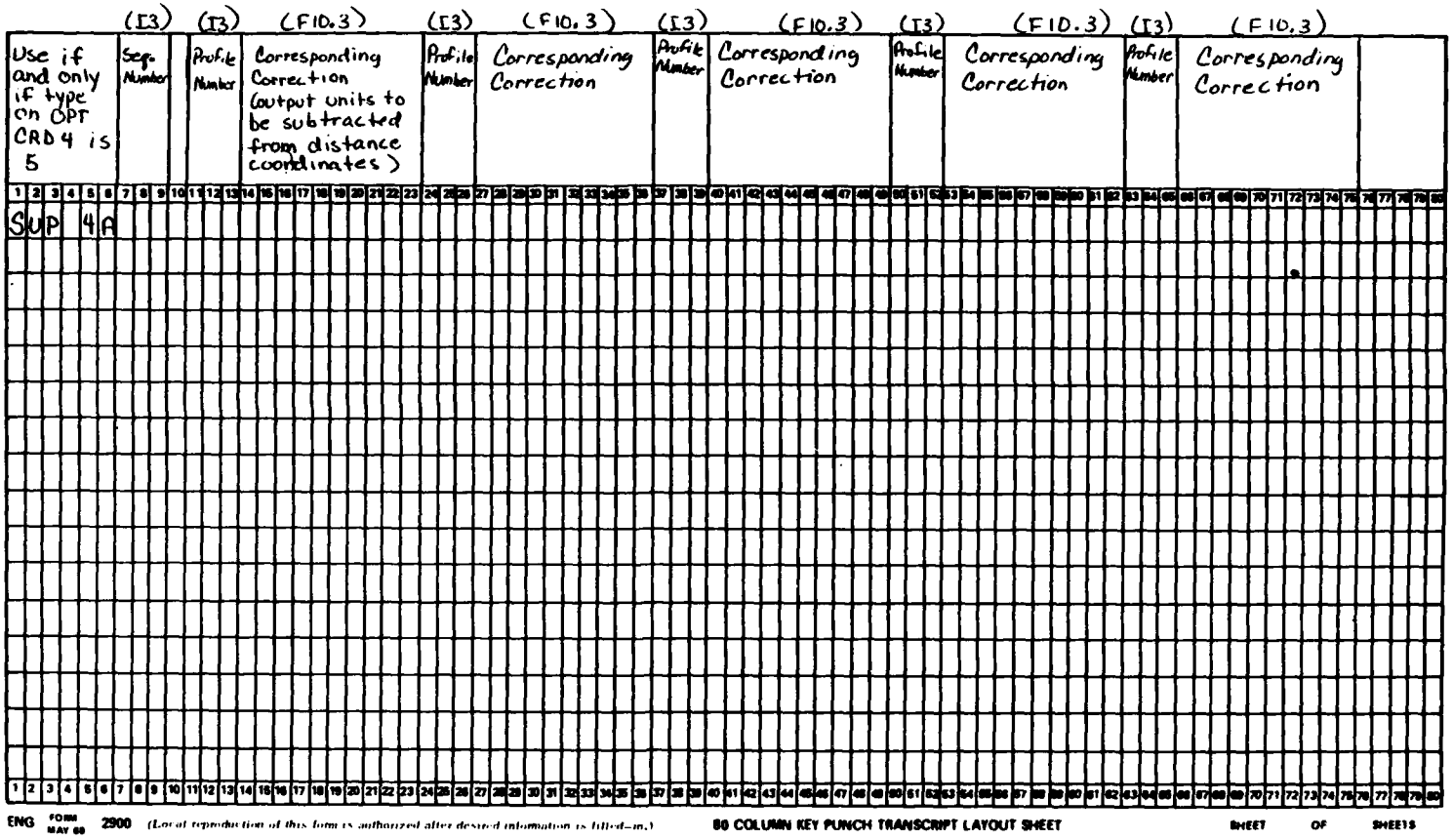
SUP 4A Cards
(must be preceded by option card 4, Format 2)



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Option Card 7

(3A10, A1)

	31 Character description of data if that on the header record is not acceptable	

OPT CRD 7

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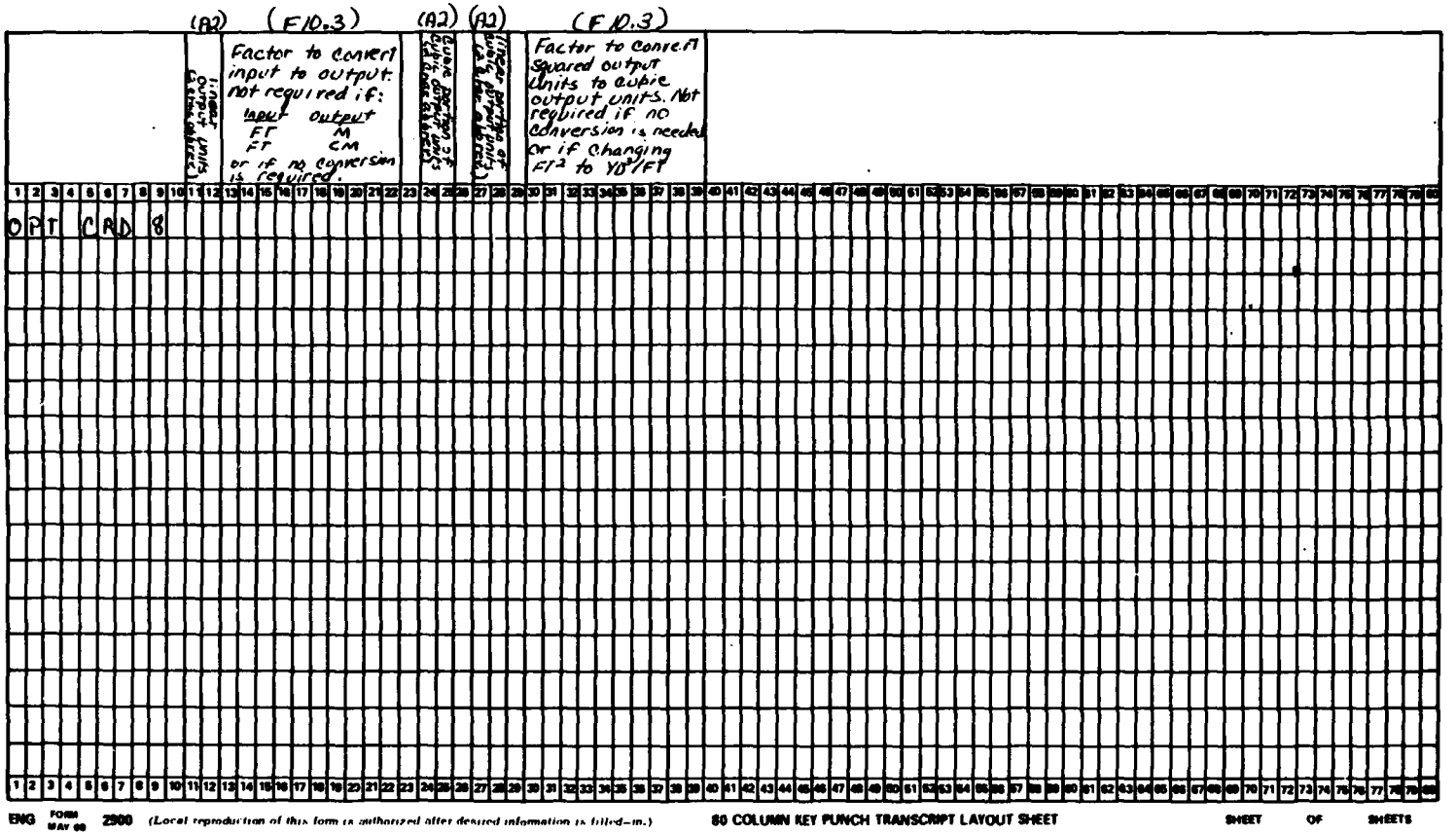
Option Card 8



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Option Card 9

(F10.3)

Minimum elevation, output units from output vertical datum, of last surveyed point from which slope line can be extrapolated

CPT CRD 9

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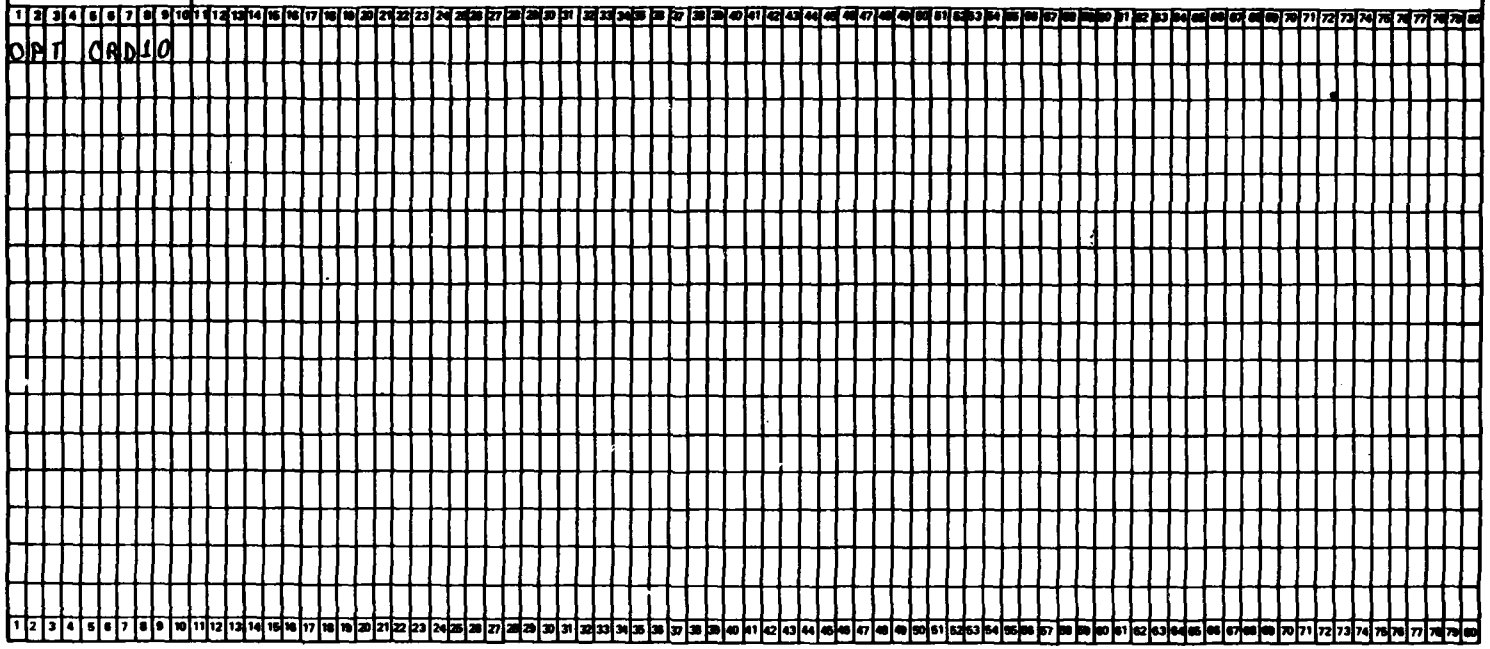
Option Card 10

(7A10)

OPT CRD10	Format of input survey data if other than one of the two described earlier.



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VOLUME Specification Card

One card only	Lower elevation[1] boundary for volume computations	Upper elevation boundary for volume computations	Segment width for volume by contour computations	[1] Elevations should be in output units relative to output vertical datum
VOLUME				

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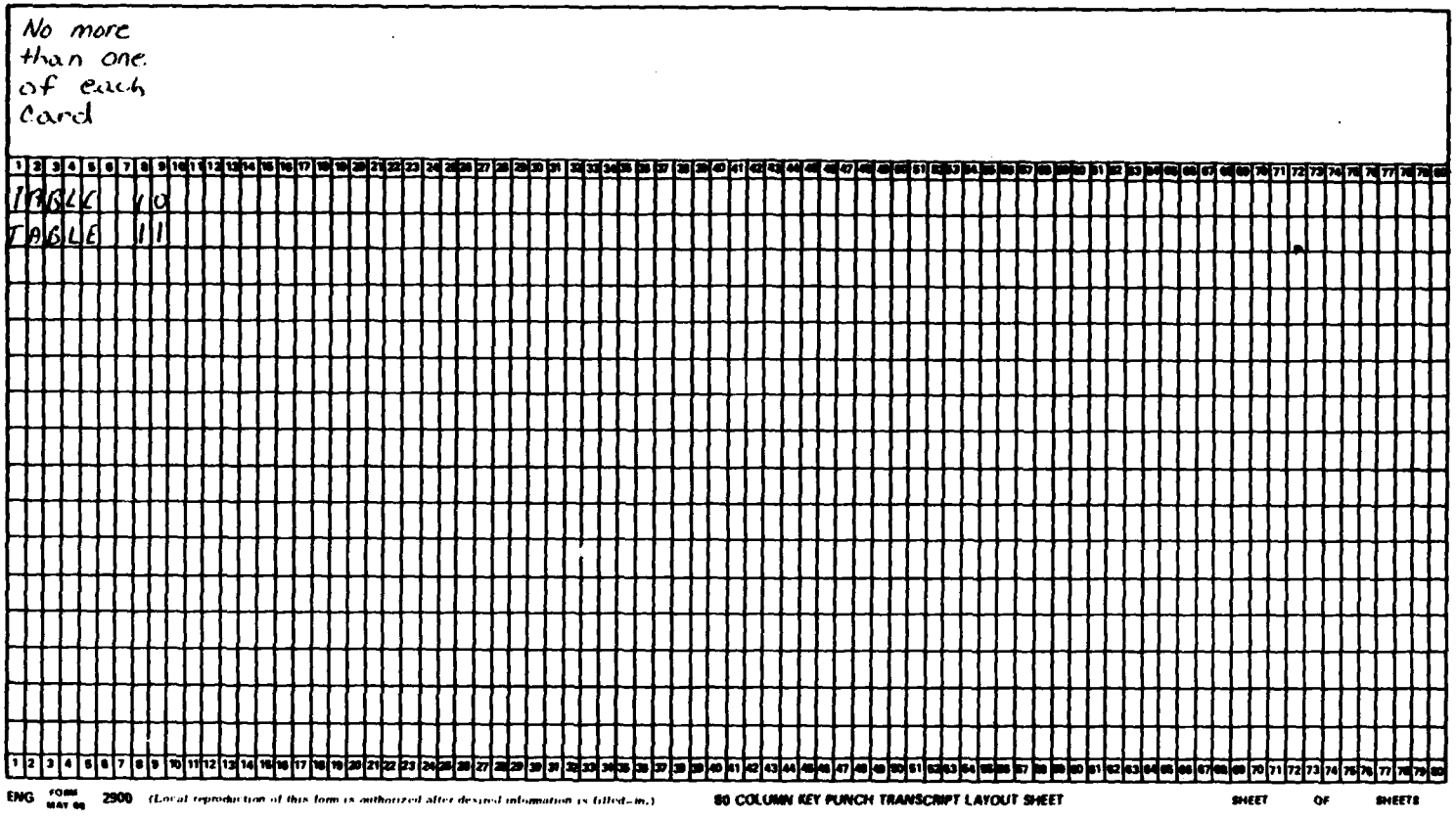
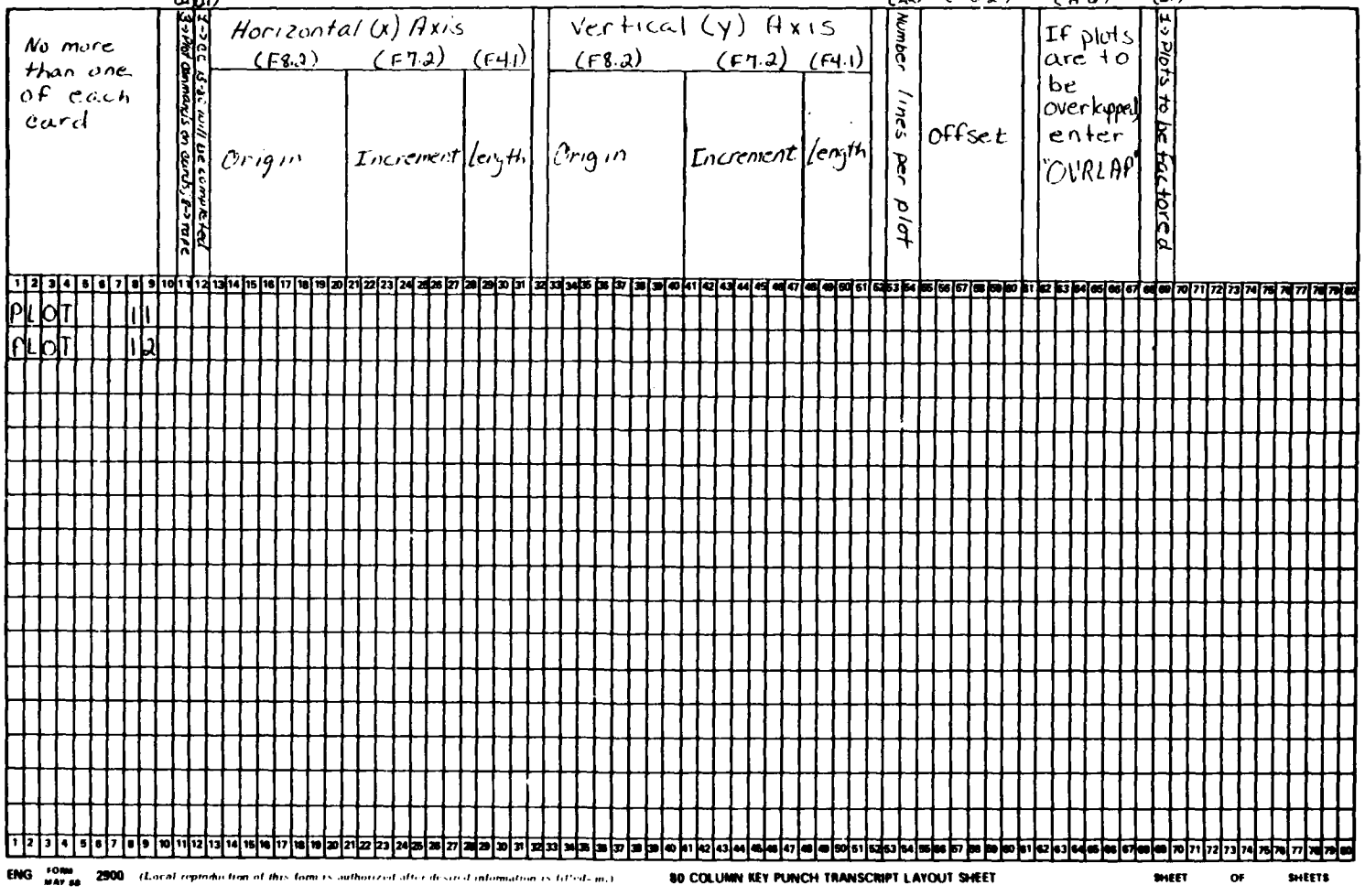
TABLE10 and TABLE11 Output Specification Cards



PLOT11 and PLOT12 Output Specification Cards



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Fleming, Marilyn V.
Beach Profile Analysis System (BPAS). Volume VI. BPAS user's guide: analysis module VOLCTR / by Marilyn V. Fleming and Allan E. DeWall.--Fort Belvoir, Va. : U.S. Army, Corps of Engineers, Coastal Engineering Research Center ; Springfield, Va. : available from NTIS, 1982.
[49] p. ill. ; 27 cm.--(Technical report / Coastal Engineering Research Center; no. 82-1 v.(VI)). Cover title.
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1. Data processing. 2. Beach Profile Analysis System. 3. Beach profile changes. 4. Computer programs. I. DeWall, Allan E. II. Title. III. Series: Technical report (Coastal Engineering Research Center (U.S.)); no. 82-1, v.VI.
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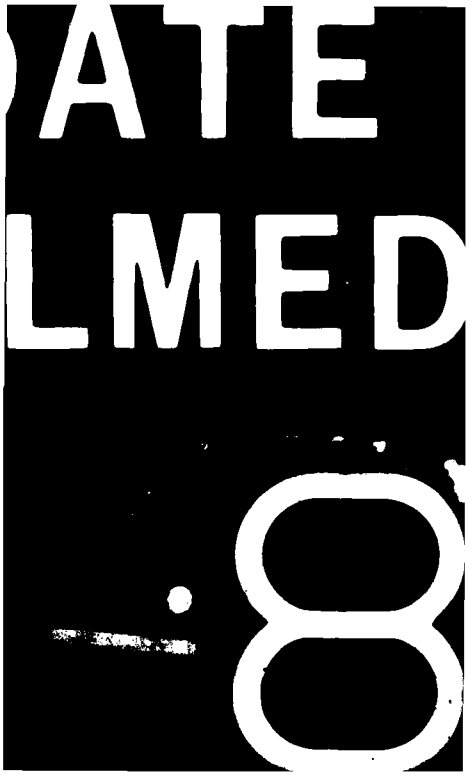
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